PROCEEDINGS *of the* HAWAIIAN ENTOMOLOGICAL SOCIETY *for* 1953

VOL. XV, No. 2
MARCH, 1954

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MEMBERSHIP 1953

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Au, Stephen
Balock, J. W.
Barker, Z. Allen
Beardsley, J. W.
Bess, Henry A.
Bianchi, F. A.
Bixby, David H.
Blalock, J. R.
Bryan, E. H., Jr.
Callan, E. McC.
Carter, Walter
Chilson, L. M.
Chong, Mabel
Christenson, L. D.
Clagg, C. F.
Clausen, C. P.
Davis, C. J.
Defibaugh, Betty Lou
Dresner, Edgar
Du Chanois, F. R.
Dumbleton, L. J.
Flitters, N. E.
Ford, E. J., Jr.
French, E. W.
Gressitt, J. L.
Hagen, K. S.
Haramoto, F. H.
Hardy, D. Elmo
Hinman, F. G.
Holdaway, F. G.
Hoyt, Charles P.
Hu, Stephen M. K.
Ito, K.
Joyce, C. R.
Kamasaki, Hitoshi
Keck, C. B.
Keiser, Irving
Kono, Constance Inada
Krauss, N. L. H.
Kumabe, Bunki
Lamprecht, Herbert
Lepesme, Pierre
Look, Wm. C.
Macdougall, G. W.
McBride, O. C.
Maeda, Shizuko
Maehler, K. L.
Marlowe, R. H.
Marucci, P. E.
Matsuura, M.
Messenger. P. S.
Mitchell, W. C.
Mumford, E. P.
Nakagawa, Patrick Y.
Nakagawa, Susumu
Nakao, Harry
Namba, R.
Newell, I. M.
Nishida, Takiyuki
Nowell, W. R.
Owen, R. P.
Pemberton, C. E.
Peterson, Geo. D., Jr.
Randall, Helen Au
Rathburn, Francis
Ritchie, C. L.
Rosa, J. S.
Sakimura, K.
Schmidt, C. T.
Sherman, John D.
Sherman, Martin
Steiner, L. F.
Stone, W. E.
Suehiro, Amy
Tamashiro, Minuro
Tanada, Yoshinori
Thomsen, Walter
Tuthill, L. D.
van den Bosch, Robert
Van Zwaluwenburg, R. H.
Verma, Jit Singh
Weber, P. W.
Wilton, D. F.
Wirth, W. W.
Yasuda, Charles
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OFFICERS FOR 1958

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HONORARY MEMBERS

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MEMBERSHIP 1958

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Au, Stephen
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Bess, Henry A.
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Bixby, David H.
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Zimmerman, E. C.

PROCEEDINGS

OF THE

Hawaiian Entomological Society

VOL. XV, NO. 2 FOR THE YEAR 1953 MARCH, 1954

JANUARY 12, 1953

The 565th meeting was held at the H.S.P.A. Experiment Station on Monday, January 12, at 2:00 p.m., with President Weber in the chair.

Members present: Balock, Barker, Bess, Bianchi, Chilson, Clagg, Ford, Fullaway, Haramoto, Hardy, Hoyt, Joyce, Keiser, Krauss, Look, Maehler, Messenger, P. Nakagawa, Newell, Nishida, Pemberton, Randall, Rosa, M. Sherman, Suehiro, Tanada, Tamashiro, Tuthill, Van Zwaluwenburg, Weber and Wilton.

Visitor: Lt. F. Robert Du Chanois, U.S.N.R.

Donald F. Wilton was elected a member of the Society, and Lt. F. R. Du Chanois was nominated for membership.

NOTES AND EXHIBITIONS

POLYPLAX SERRATA (Burmeister)—Dr. Joyce exhibited a slide mount of a female anoplurid which he had identified as this species, one not previously recorded from these islands. The specimen is from the mouse *Mus musculus,* and was in the slide collection of the H.S.P.A. Experiment Station, labeled "ex white mouse, U.S. Army, Oahu, March, 1945." *P. serrata* is readily separated from other closely related species of the genus by the fact that the dorsal marginal seta of the fourth paratergite is about three times the length of the ventral seta. The louse was no doubt brought in on importations of laboratory mice, and may be more prevalent here than records indicate.

AGONOXENA ARGAULA Meyrick—Mr. Krauss reported that larvae of this moth, which attacks coconut and other palms, were found on coconut leaves at Lawai-Kai, Koloa, Kauai, in December, 1952, by Stephen Au. This is the first record of this species from Kauai.

EPINOTIA LANTANA (Busck)—Mr. Krauss pointed out that this is the correct name for the olethreutid moth introduced by Koebele into Hawaii from Mexico in 1902 to help control lantana. It has previously been known here as *Crocidosema lantana;* the new name was given the moth by Heinrich (Proc. U.S. Nat. Mus. 79, no. 2879:10-11, 1931).

CLIDEMIA HIRTA—Mr. Krauss reported that this noxious weed (family Melastomaceae) has become established in the forest reserve at Kaukonahau, Wahiawa, Oahu. Karl Korte, a forester of the Board of Agriculture and Forestry, says that he first noticed the plant in this region in 1941. It is now found in an area somewhat less than one mile square. The plant was a serious pest on grazing land in Fiji some years ago, but was brought under effective control by the thrips, *Liothrips urichi* Karny, introduced from Trinidad, B.W.I., by H. W. Simmonds in 1930. The plant is known in Fiji as "Koster's curse"; it is native to the region from Mexico and the West Indies south to Bolivia and southern Brazil. It has black, juicy berries, and the seeds are spread by the birds. Dr. Pemberton added that the difference in *Clidemia* infestation in Fiji was most striking between 1920, when the plant made certain areas impenetrable, and 1937, after the plant had been all but eliminated in some sections by *Liothrips*.

PYRAUSTID LARVAE AS BIRD FOOD—Mr. Maehler reported that a shipment of nightingales recently passed through Honolulu en route to the mainland United States from Japan. Accompanying them, to serve as food for the birds in transit, were some 150 living larvae of the lepidopterous family Pyraustidae. The insects were confiscated.

PRAYS sp.—Mr. Chilson reported that larvae of hyponomeutid moths caught by Mr. Ford among *Pelea* berries from the Waianae Mountains, Oahu, had been determined by H. W. Capps as *Prays* sp. Later, the species was believed to be *P. fulvocanellus* Walsingham, which Dr. Swezey (in manuscript) records as feeding in buds and seeds of *Pelea*.

EURYTOMA ORCHIDEARUM (Westwood)—Mr. Look reported that C. J. Davis found the Cattleya fly for the first time on the island of Hawaii in a nursery at Kukuau, near Hilo, on December 29, 1952.

SPALANGIA LANAIENSIS Ashmead—Mr. Fullaway reported that this pteromalid parasite of drosophilid flies has recently appeared in fly material from various island localities. On November 25 and 26, 1952, it was reared from material from mountain apple (*Eugenia malaccensis*) and *Momordica* from Waimea and Pakala, Kauai. On December 10 it was obtained from guava material from Haiku, Maui, and December 15-17, 1952, from Damson plums (*Chrysophyllum oliviforme*) and guavas from Wahiawa, Waianae, and Honolulu, Oahu.

TETRASTICHUS DACICIDA Silvestri—Mr. Fullaway reported the recovery for the first time on Kauai of this eulophid parasite of *Dacus dorsalis*. It was bred from wild *Momordica* collected November 19, 1952, at Hanapepe and Makaweli.

PARASITE OF COCONUT RED SCALE—Attention was called to a paper by Dr. R. L. Doutt (Ann. Ent. Soc. Amer., 43:501-507, 1950) in which *Anabrolepis oceanica* is described from the Caroline Islands. This is an encyrtid parasite of *Furcaspis oceanica* Lindinger, the coconut red scale. Also described in the same paper is an aphelinid, *Ablerus palauensis*, presumed to be hyperparasitic on *Anabrolepis*.

OREOCRABRO ABNORMIS (Blackburn and Cameron)—Mr. Weber exhibited a long series of both sexes of this rather uncommon wasp, taken January 10 at the base of Mt. Kaala in the Waianae Mountains, Oahu. The male is remarkable for the strongly developed tooth on the antennae.

PETROBIA sp.—Dr. Martin Sherman reported that on May 8, 1951, an infestation of this tetranychid mite was noted on sweet potato plants in an experimental area at Poamoho, Oahu, which had been sprayed with DDT on April 6. The unsprayed plants were free from this large black mite. Sulfur was added to subsequent DDT sprays, and by June 1 the infestation had been controlled. This is the first record of this genus from the islands. Dr. I. M. Newell, who identified the mites, said that, as far as he knows, this is the first record of any mite of this genus building up populations on plants sprayed with DDT.

FEBRUARY 9, 1953

The 566th meeting was held at the H.S.P.A. Experiment Station on Monday, February 9, at 2:00 p.m., with President Weber in the chair.

Members present: Balock, Bess, Bianchi, Carter, Chilson, Christenson, Dresner, Du Chanois, Fullaway, Hinman, Hoyt, Keck, Krauss, Look, Messenger, Mitchell, Pemberton, Sakimura, Tanada, Tuthill, Van Zwaluwenburg, Verma and Weber.

Visitors: David H. Bixby and George E. Bohart.

Lt. F. R. Du Chanois was unanimously elected a member of the Society, and Dr. Herbert Lamprecht, Director of the Plant Breeding Institute of Landskrona, Sweden, was nominated for membership.

NOTES AND EXHIBITIONS

Dr. Bess exhibited two bulletins recently published by the Entomology Department of the Hawaii Agricultural Experiment Station, one on garden pests, the other on household insects.

DACUS DORSALIS Hendel—Dr. Tuthill reported that adult males of the oriental fruit fly were attracted to drying twigs of mokihana (*Pelea* sp.) which had been brought into the laboratory to rear out psyllids present on them. Although quite dry, the foliage was still fragrant. The flies were evidently drawn from some distance, as there was no possible breeding source within 50 yards, and no probable source for a much greater distance.

CORIXIDS IN OCEAN WATER—Dr. Tuthill reported adult corixid bugs (no nymphs) in the Ala Moana yacht basin; they were not in tidal pools.

COPTOTERMES FORMOSANUS Shiraki—Mr. Keck reported that a carton nest of the subterranean termite, some 16 inches in diameter, was found recently at Pearl Harbor, in a cavity in a manhole made for the installa-

tion of underground cables. The carton was examined in the hope of finding a primary queen. Instead, 137 supplementary queens were found; these were exhibited, together with a primary queen from another source, and eggs of *C. formosanus*. A note from Mr. Rosa reported a large flight of *C. formosanus* on Keeaumoku Street, Honolulu, at about 10 in the morning of January 13, an overcast day.

PROTAETIA FUSCA (Herbst)—Dr. Pemberton exhibited rose buds almost completely eaten by adults of this immigrant beetle; they came from the rose gardens of Mr. Watanabe at Koko Head, Oahu. The beetle was reported as causing much damage to roses in this commercial garden; it is the first record of economic damage by this insect in Hawaii. It was recalled that *Scolia vollenhoveni* Saussure parasitizes the larvae of *P. fusca* in Malaya. Mr. Bianchi reported finding *Protaetia* larvae in dust-dry soil near Diamond Head.

OPIUS sp.—Mr. Fullaway exhibited a new species and several new varieties of *Opius*, which he intends to describe.

ENCYRTUS LECANIORUM (Mayr)—Mr. Chilson reported that a single female of this parasite of scale insects was taken at the Honolulu Airport on blossoms of *Alpinia purpurata* originating in Honolulu, on September 9, 1952, by E. H. Davidson. This is the first time this species has been recorded in Hawaii; identification was by B. D. Burks of the U.S. National Museum.

PSEUDOCOCCUS NUDUS Ferris—Dr. Hoyt reported that this insect, described from a single specimen of *Dubautia* from Haleakala, Maui, (in Zimmerman: "INSECTS OF HAWAII," 5:235, 1948) was found in large numbers in the crater of Haleakala in June, 1951. On October 29, 1952, Dr. Hoyt took a single specimen on *Dubautia arborea*, in Kaula Gulch, two miles above Keanakolu, Hawaii. This is a new island record for this endemic species.

ORCHIDOPHILUS ATERRIMUS (Waterhouse)—Mr. Krauss reported that Mr. Davis took this orchid weevil in Hilo, Hawaii, on *Phalaenopsis* plants, last November. Apparently the insect is rare on Hawaii; it was first taken on that island in Hilo by L. W. Bryan in April, 1930 ("PROCEEDINGS," 7:376, 1941[1]).

BRACHYMERIA AGONOXENAE Fullaway—Mr. Krauss reported the rearing of this chalcid from *Agonoxena argaula* Meyrick, by Stephen Au on Kauai, in January, 1953. This is a new island record for this parasite, introduced from Samoa in 1948, and within a year established on Oahu.

LEMA CALIFORNICA Schaeffer—Mr. Bianchi reported unusual numbers of this chrysomelid beetle on Jimson weed which now occupies areas of "new" land in the Pearl Harbor region. These areas have recently been filled in by deposits of soil from cane cleaners at nearby sugar mills.

[1] Here, and elsewhere in this publication, "PROCEEDINGS" refers to the Proceedings of The Hawaiian Entomological Society.

Dr. George Bohart gave an interesting account of his two months on the Ryukyus and nearby islands. The main objective of his trip was the study of a filarial disease of horses which occurs on some of the Ryukyu Islands, and which often causes blindness in its victims. Unlike most filarial diseases, this one tends to produce open sores. Only a brief time was available for work before the transmission season of the disease ended, but Dr. Bohart's observations implicate as a vector an undescribed *Musca*, in the mouthparts of which he found adolescent filarial worms. Infection probably takes place by way of the open sores, and by the rasping of unbroken skin by the heavily-armed mouthparts of the adult flies.

Malaria occurs in the Ryukyus inland from the coast. In rice paddies the vector is *Anopheles sinensis* Wiedemann, while in the foothill streams the species is *A. minimus* Theobald. After discussing some of the important crop pests, Dr. Bohart told of a non-social, gregarious, ground-nesting bee, *Anthophora* sp., a number of pupae of which he is bringing to the mainland United States in the hope of improving pollination of various crops. A survey made by Dr. Bohart revealed about 1,800 insect species in the Ryukyus. Of these the Diptera comprise some 300 species, the Coleoptera and Hymenoptera some 250 each, the Lepidoptera about 200 (butterflies are numerous), and the Hemiptera about 100 species.

MARCH 9, 1953

The 567th meeting was held at the H.S.P.A. Experiment Station on Monday, March 9, at 2:00 p.m., with President Weber in the chair.

Members present: Adachi, Balock, Barker, Bess, Bianchi, Chilson, Chong, Clagg, Dresner, Fullaway, Gressitt, Hinman, Hoyt, Joyce, Keck, Keiser, Krauss, Look, Maehler, Messenger, P. Nakagawa, Rosa, Suehiro, Tamashiro, Tanada, Tuthill, Van Zwaluwenburg, Verma and Weber.

Visitor: Miss Setsuko Nakata.

A communication was read from the Hawaiian Academy of Science, inviting affiliation by the Society with the Academy for mutual benefit. Dr. Herbert Lamprecht was elected a member of the Society, and Mr. L. J. Dumbleton was nominated for membership.

Notes and Exhibitions

Carpet beetles—Dr. Bess exhibited wood damaged by *Cryptotermes brevis* (Walker); the termites had been killed by fumigation, but the old galleries were occupied by larvae and adults of an *Anthrenus*, probably *scrophulariae* (L.). The larvae were feeding on the dead termites present in the galleries.

Collecting in the Carolines—Dr. Gressitt told of his 11-weeks visit to the Caroline Islands, during which all the high islands were visited, and a few of the atolls. A few days were also spent on Guam, and brief

stops made on Johnston, Wake and Kwajalein Islands. The main purpose of the trip was to fill gaps in the collections of the Insect Survey of Micronesia. Particular emphasis was placed on light-trapping, especially at high altitudes, the use of the Berlese funnel and beating of native vegetation at high altitudes. Over 60,000 specimens were taken, the bulk of them minute night-flying insects, soil arthropods and small plant-feeding insects.

Six days were spent on Yap. Adults of three new caddis flies, previously known only from larvae, were taken, but the mayfly (the only record from Micronesia), known only from a nymph, was not obtained. Though Yap has been said to be a continental island and has more aquatic insects than other parts of Micronesia, it appears poor in some of the conspicuous groups such as the weevils and other forest-feeding beetles.

Palau was visited for three weeks, part of which was spent reviewing the *Oryctes* situation. This pest, the coconut rhinoceros beetle, is dwindling in numbers as a result of gradual depletion of larval food, its own feeding and the work of the control crew. Palau has the most varied fauna in Micronesia, and probably the richest, though it has fewer endemic genera than Ponape. Palau has four species of hispid beetles, whereas not more than one has been found in any other island group of Micronesia, and none on Guam. Three of the four hispids are *Oxycephala,* all found within a few yards of each other on Babelthuap; one, a new species first taken on this trip, occurs on *Freycinetia,* and the other two on *Pandanus* of two types. The more common of the *Pandanus* hispids also feeds in *Flagellaria, Pleomela* and *Freycinetia.* The fourth species is *Brontispa palauensis* (Esaki and Chujo), described by Barber in 1950 as *B. yoshinoi,* and studied under that name by Hagen and Doutt (Ann. Ent. Soc. Amer., 43:311-319, 1950). The first description of *B. palauensis* in English appeared in 1943 (Mem. Fac. Sci. and Agr., Taihoku Imp. Univ., 24:322). The other two hispids in Micronesia are *Brontispa chalybeipennis* (Zacher) which occurs in Ponape, Kusaie and other Marshall Island atolls, and *B. mariana* Spaeth. The latter is probably native to the Truk area and may have been introduced into the Marianas, where it is known as the Saipan coconut beetle.

Truk, where three weeks were spent, proved disappointing, and appears much poorer than the other high island groups; it is particularly lacking in weevils and other types characteristic of Guam, Palau and Ponape. The Truk islands are sunken peaks of a large island and the native vegetation is nearly gone. Ponape, visited for nearly three weeks, is the highest of the large islands, and is rich. Rain forests and swamps on the mountain summits are conspicuous. Damsel-fly nymphs were taken in *Pandanus* and *Freycinetia* axils; large weevils, tettigoniids and gryllids were taken in *Pandanus* on the mountain tops.

Kusaie, where only three days were spent, is similar to Ponape, but with steeper mountains and sharper ridges. It is richer than has been assumed, and probably has many endemic species. Dr. J. F. Gates Clarke is spending four months collecting there. The eastern Caroline atolls, Mokil and Pingelap, visited briefly are probably not very different in

their insect fauna from the western Caroline atolls visited recently by N. L. H. Krauss.

Dr. Gressitt announced that the Bishop Museum has received a grant of $15,200 from the National Science Foundation to help support the project "INSECTS OF MICRONESIA" for the next 18 months. The project is thus now transferred from the Pacific Science Board to the Bishop Museum, and Dr. Gressitt has joined the Bishop Museum staff. Under the new director, Dr. Alexander Spoehr, it is planned to expand the role of entomology in the Bishop Museum in the near future. A fine collection from the southern Ryukyu Islands was recently left at the Museum by Dr. George Bohart. It is hoped that the Museum may prove useful to all local entomologists in helping to identify specimens or in supplying information.

RECENT BEETLE CAPTURES—For Mr. Ford, Mr. Maehler reported the following recent captures of beetles: *Neoclytarlus chenopodii* Perkins, 13 specimens bred February 18, from *Chenopodium oahuensis*, 1,800 ft., Palikea, Waianae Mountains, Oahu. *Plagithmysus cuneatus* Sharp, 12 specimens, on *Sapindus oahuensis*, 2,000 ft., Palikea, Oahu, February 26; the last record of the capture of this species was by Dr. Swezey in February, 1937. Also reported is the capture of an unidentified curculionid, apparently new to the Hawaiian Islands. It was first collected at Barber's Point, Oahu, in March, 1950; an additional series of 28 specimens was collected at Damon Tract and Hickam Field in January, 1953. Both adults and larvae were feeding on *Portulaca*.

AGONOXENA ARGAULA Meyrick—Mr. Krauss reported that larvae of this moth were found by C. J. Davis on coconut leaves between Kailua and Keauhou, Hawaii, on March 3, 1953. This is the first record of this insect from the island of Hawaii.

ANACAMPTODES FRAGILARIA (Grossbeck)—Mr. Tanada reported rearing this moth from larvae on broccoli on the University of Hawaii campus, and at Waimanalo experimental farm, during January and February. The insect was fairly abundant and was the most numerous species on broccoli with the exception of *Pieris rapae* (L.).

ACHETA DOMESTICA (L.)—Mr. Chilson reported that a single female of this cricket, determined by A. B. Gurney, was found by S. P. McNeil at the Honolulu Airport in a box of croton leaves being sent from Honolulu to California, August 20, 1952. It is not certain that the insect is established here. The remarks that follow are paraphrased from Dr. Gurney's letter: Keys out to *A. conspersa* (Schaum) (Zimmerman: "INSECTS OF HAWAII," 2:129, 1948) but is decidedly larger, the occipital pale band is much wider, and pronotal coloration and other features are different. This species may be a newly established one in Hawaii, and a further investigation might be justified, as *domestica* is of some importance in buildings . . . in addition to being a species of general interest.

Mr. Clagg spoke of a recent trip to Midway Island, where he spent nine days. It is his opinion that there are more insect species now established

there than were known at the time of the last published survey made some years ago.

EGG LAYING OF PEREGRINUS MAIDIS (Ashmead)—Mr. Verma reported that during a study of the corn leafhopper he found that about 90 per cent of the corn plants (then from 9 to 12 inches high) in the field had ant burrows near the roots. The majority of the *P. maidis* were found within these burrows, some of them as much as five inches below the soil surface. Upon examination of corn plants under a binocular microscope, it was found that over 95 per cent of the leafhopper eggs were laid either in the corn stem below the soil surface, or in the corn roots themselves. Nymphs were observed hatching from these eggs.

Further study revealed that *P. maidis* also lays the eggs in nutgrass (*Cyperus rotundus*) roots. Eggs were found in nutgrass roots only in corn fields and particularly in plants adjacent to corn plants. No nymphs or adults of the bug predaceous on leafhopper eggs, *Cyrtorhinus mundulus* (Breddin), were found in the ant burrows or even on the above ground parts of the young plants. In view of the fact that nymphs and adults of *C. mundulus* die if starved for from 18 to 26 hours, it becomes apparent why corn leafhopper populations build up so rapidly while *Cyrtorhinus* often is scarce. There appears to be a close dependence of the subterranean population of *P. maidis* on the ants in a corn field because no *Peregrinus* population was found where the ant burrows were absent.

APRIL 13, 1953

The 568th meeting was held at the H.S.P.A. Experiment Station on Monday, April 13, at 2:00 p.m., with President Weber in the chair.

Members present: Adachi, Balock, Barker, Bess, Bianchi, Chong, Clagg, Du Chanois, Fullaway, Gressitt, Haramoto, Hinman, Hoyt, Ito, Joyce, Keck, Keiser, Look, Maehler, Messenger, P. Nakagawa, Newell, Pemberton, Rosa, M. Sherman, Suehiro, Tamashiro, Tanada, Tuthill, Van Zwaluwenburg, Verma and Weber.

L. J. Dumbleton was unanimously elected as a member of the Society.

NOTES AND EXHIBITIONS

TEFFLUS HACQUARDI de Chaudoir—Miss Chong reported that one female of this carabid beetle was found alive on March 4, 1953, by a Mrs. Wist at Kaneohe, Oahu, not far from the point where the species was originally released on June 3, 1952. The individual is believed to be the progeny of the original released material for it bore no markings such as were applied to all the released specimens.

OPIUS KRAUSSII Fullaway—Miss Chong reported the recovery of this introduced parasite of fruit flies on the island of Hawaii. About ten, evenly divided as to sex, were bred by Mr. Susumu Nakagawa from Jeru-

salem cherries collected March 8, 1953, at Waikii, Hawaii. The parasite had earlier been recovered on Maui ("PROCEEDINGS," 14:361, 1952).

TAROPHAGUS PROSERPINA (Kirkaldy)—It was reported that the taro leafhopper was reported for the first time from Waipio Valley, Hawaii, by C. J. Davis, who found it there on November 26, 1952. It had earlier been found in Hilo, Hawaii, by W. C. Look on September 19, 1947. Of 65 acres of taro in Waipio Valley, only five were found to be infested. The egg predator *Cyrtorhinus fulvus* Knight was released in the infested area: 2,455 in December, 1952, and 433 the following March.

NEW RECORDS FROM THE ISLAND OF HAWAII—For Mr. Davis the following, all new records for the island of Hawaii, were reported:

EURYTOMA ORCHIDEARUM (Westwood), the Cattleya fly, was reported in Hilo on December 27, 1952, by the Reverend Masao Yamada. This was confirmed when a moderately heavy infestation was found December 29 in the Kukuau district of the town. It has since been found in upper and lower Kaumana and at Piihonua, but not in any other parts of the island.

OESTRUS OVIS L., the sheep nostril, or bot, fly, was identified by Dr. D. Elmo Hardy from maggots obtained from a goat at Kahuku Ranch in March, 1953. The record of a goat as host is considered very unusual, particularly since it occurred in the horn of the animal, not in its nasal passages.

CEROPLASTES CIRRIPEDIFORMIS Comstock—Dr. Sherman reported that this barnacle scale, tentatively identified as such by Harold Morrison, was collected on December 13, 1952, at the faculty housing area, Manoa Valley, Honolulu, on the stems of *Passiflora edulis flavicarpa*. This is the first record of this scale in the Hawaiian Islands.

MITES ON COFFEE—Dr. Sherman reported that on April 1, 1953, he noted that the minute pits at the base of the veins on coffee leaves in Kona, Hawaii, were often occupied by mites identified by Dr. I. M. Newell as belonging to the family Tydeidae. The pits were not caused by the mites, which had only taken advantage of them to hide. Dr. Newell added that examination of coffee leaves on Oahu shows the presence of similar mites of a species different from the ones found in Kona. The group in part has recently come to be considered phytophagous.

VANDUZEA SEGMENTATA (Fowler)—Mr. Van Zwaluwenburg reported finding this membracid in all stages on *Erigeron*, at Mapulehu, Molokai, on March 20. This is a new island record for the species.

DROSOPHILA HYDEI Sturtevant—Mr. Clagg reported that drosophilid flies, mostly of this species (identified by Dr. Hardy), were recently so numerous in Navy housing residences as to be a nuisance. The flies are believed to have bred in unusual numbers in cactus which was cut down in the development of the nearby Aliamanu housing area.

MUSCINA ASSIMILIS (Fallén)—Dr. Hardy reported a new fly record for the Territory. This fly, identified by C. W. Sabrosky, was reared from larvae in cabbage at Kamuela, Hawaii, by A. Kawasaki in March. The species is widely distributed throughout the Palearctic, Nearctic and Neotropical regions, and has been reported in the literature as at times causing fatal myiasis in nesting birds. This is the second species of *Muscina* known to occur in Hawaii; our species may be separated by the following characters:

Palpi, tibiae, and apical half of femora yellow	*stabulans* (Fallén)
Palpi and legs entirely black	*assimilis* (Fallén)

The *Muscina* are distinguished from other muscoid flies by their robust bodies, by having the arista plumose on both sides, by the evanescent anal vein not reaching the wing margin, by the short, thick proboscis and fleshy labellum, and by having vein M_{1+2} broadly rounded at the apex, not bent forward at a sharp angle.

Dr. Bess commented on the extremely low flea populations reported on living trapped rats in the Hamakua district of Hawaii. Dr. Pemberton pointed out that although fleas have always been few on field rats (*Rattus hawaiiensis*) in that district, they are abundant on the rats about houses (the Norway rat). He added that damage by the Norway rat has always been high on the islands of Lanai and Kauai, the two islands in the Hawaiian group on which the mongoose has never been introduced.

Dr. Gressitt announced that preceding the XIVth International Congress of Zoology in early August, 1953, in Copenhagen, the International Commission on Zoological Nomenclature will hold a Colloquium on Nomenclature to complete the revision of various parts of the International Code of Zoological Nomenclature, to prepare a final new draft to be presented for approval to the International Congress, and to make various recommendations on opinions and interpretations of the Code. This is to be a significant meeting as many important points brought up at the last Congress, or later, in the Bulletin of Zoological Nomenclature, will be acted upon.

Mr. Maehler reported that Dr. W. W. Wirth, a member of this Society, had recently been awarded the Meritorious Award of the U.S. Department of Agriculture for scientific achievement.

IRIDOMYRMEX HUMILIS (Mayr)—Mr. Ito said that recently Mr. H. Matsui of the Hawaiian Pineapple Co. reported finding large colonies of this ant along the edge of Field 4109, one of those recently taken over from sugar production in upper Waipio, Oahu. Checking the area toward the end of March, the ant was found well established along some 675 feet of the field's margin, completely overrunning the banks of nearby Reservoir 36, with the exception of one point where a colony of the fire ant (*Solenopsis geminata rufa* [Jerdon]) persisted. The Argentine ant has followed the ditch about 500 yards makai (seaward) of the reservoir to the intersection with the Waipio radio station road.

The fact that the ant has not advanced across the paved road into Panakauahi Gulch, except via a culvert, seems to indicate that the infestation

is an isolated one centering at the reservoir. *Pheidole* ants predominate in the surrounding areas, notably in the now abandoned camp site some 750 yards below the reservoir.

Mr. Ito also reported the presence of the Argentine ant in Wahiawa Heights, Oahu, where the first report was of an infestation in a house on California Ave. The ant is said to have been in this area for from two to four years. Surveying along California Ave., the ant was found on the south side of the street as far down as Uluwehi St., above Leilehua High School, and up to the end of the avenue into the Koolau forest area. The spread into the fenced-in 13th Replacement Camp site, presumably the original place of infestation, was not determined. North of California Ave. the ant has advanced into the forest region, beyond the edge of the Heights and on to the end of Dole Road. Apparently the ant has not yet invaded the Eames tract or the Wahiawa forest reserve areas.

PHYTOLIRIOMYZA MONTANA Frick—Miss Adachi reported that this recently described agromyzid was found in large numbers on April 3 at the radar station on Mt. Kaala, Oahu, on all plants swept with a net. Larvae of other species of this genus are known to be stem-miners in various plants, but none of the plants examined on the summit of Mt. Kaala showed any such injury.

MAY 11, 1953

The 569th meeting was held at the H.S.P.A. Experiment Station on Monday, May 11, at 2:00 p.m., with President Weber in the chair.

Members present: Adachi, Barker, Bess, Bianchi, Bryan, Chilson, Chong, Christenson, Ford, Fullaway, Gressitt, Haramoto, Joyce, Look, Maehler, Messenger, Newell, Pemberton, Rosa, Suehiro, Tanada, Tuthill, Van Zwaluwenburg, Verma, Weber and Wilton.

The name of Miss Shizuko Maeda was proposed for membership.

PAPERS

Miss Adachi presented the following papers by title: "An Undescribed Cranefly from the Hawaiian Islands (Diptera: Tipulidae)," by Charles P. Alexander, and "A Revision of the Psychodidae of the Hawaiian Islands (Diptera)," by Larry W. Quate.

NOTES AND EXHIBITIONS

PARAFANNIA MOLLUSCOVORA Bohart—Dr. Joyce reported that a specimen of this fly was collected on September 11, 1952, at Fort Armstrong, Honolulu, from decaying shellfish near the beach. This phorid genus has not previously been reported from the Islands; it has been known only from Guam, and breeds abundantly in decaying shellfish. The species is characterized by its sooty black color, unbranched radial vein, the clypeus

produced at the oral margin, and the hind tibia with a spine on its outer surface near the base.

DIPLONEURA CORNUTA Bigot—Dr. Joyce reported that this species of phorid fly should also be recorded as occurring on Oahu, numerous specimens in his collection dating back to July 21, 1947. The species is worldwide in distribution in tropical and temperate zones, and breeds extensively in decaying vegetables and meat, in much the same situations as *Megaselia scalaris* Loew. This species is distinguished by having the preantennal bristles directed backward, the radial vein branched and by the presence of a stout pair of bristles on the outer surface of the middle tibia.

PHAENICIA CUPRINA Weidemann and P. SERICATA (Meigen)—Dr. Joyce said that mention should be made concerning the occurrence of these species in the Hawaiian Islands. James ("Flies that Cause Myiasis in Man," U.S. Dept. Agr. Misc. Pub. 631:85-87, 1947) reports that both species are found here. Tanada et al. (J. Econ. Ent., 43:31, 1950) record a *Phaenicia* sp., near *pallescens* and *cuprina*, as breeding in poultry manure. There is no mention whatever in the "PROCEEDINGS" of *P. cuprina*.

Dr. Joyce finds *P. cuprina* one of the most abundant calliphorid flies here. In carrion-baited traps in lowland areas it usually outnumbers *P. sericata* 3 to 1. He has collected it in numbers from 1947 to date. It is felt that there must have been some confusion locally as to the identity of these species. *P. sericata* has been reported frequently in the "PROCEEDINGS" since 1912. It is worldwide in distribution whereas *cuprina* is principally Oriental and Australian in distribution; *cuprina* is the most serious of the sheep maggots in Australia. *P. sericata* is dark green, whereas *cuprina* is more cupreous; furthermore, in *cuprina* the metasternum is bare, while in *sericata* it is setose.

COPTOTERMES FORMOSANUS Shiraki—Dr. Bess commented on an unusually heavy flight of this termite in the early evening of May 1, in the mauka sections of Honolulu, particularly the Punchbowl area and Kalihi, at a time when "kona" conditions prevailed. Mr. Christenson remarked that at about the same time there was a heavy flight of this termite in Hilo. Various members commented on the possible correlation between the building of above-ground tubes and the preparation of colonies for flights. Mr. Rosa stated that *C. formosanus* occurs in parts of Honolulu as high as 700 feet elevation, on Alewa, Pacific, and St. Louis Heights and on Wilhelmina Rise.

SYBRA ALTERNANS (Wiedemann)—Dr. Gressitt stated that examination of local material of this beetle, the identity of which was recently questioned, shows it is apparently correctly named. Apparently the first proper assignment of *alternans* to the genus *Sybra* was by Fullaway ("PROCEEDINGS," 5:76, 1922) on the basis of a determination by G. E. Bryant of the British Museum. The Gemminger and Harold catalogue and the Lacordaire "GENERA DES COLEOPTERES" both assigned "*alternans* Eschch." to *Sybra*, but that was not a valid name. Breuning (Festschr. 60 Geburtst.

E. Strand, 5:265, 1939) reassigned *alternans* (Wiedemann) from *Pterolophia* to *Sybra,* apparently in the belief that he was the first to do so.

Dr. Gressitt exhibited a copy of the newly issued "METHODS AND PRINCIPLES OF SYSTEMATIC ZOOLOGY," by Ernst Mayr, E. Gorton Linsley and R. L. Usinger, and mentioned "THE INSECT LIFE OF ARNO" by R. L. Usinger and Ira LaRivers, just published as No. 15 of the Atoll Research Bulletin. He added that Dr. J. F. G. Clarke, the microlepidopterist, arrived from Kusaie on May 8th; Dr. Clarke collected between 800 and 900 species of insects on Kusaie, the first collection of any size to be made there. These will be mounted except for the Microlepidoptera at the Bishop Museum.

NESOTOCUS GIFFARDI Perkins—This species, found on araliaceous trees, has until now been reported only from the Koolau Mountains on Oahu. Mr. Ford reported that in February, 1953, he took it for the first time in the Waianae range on *Cheirodendron,* at an elevation of 4,000 ft. on Mt. Kaala. Numerous exit holes and larvae were seen, but only the remnants of one adult beetle were found.

CHRYSOBOTHRIS near TRISTIS Deyrolle—Mr. Rosa exhibited an adult of this infrequently collected buprestid beetle, which bit a boy on the lip in Honolulu as he was walking along. The identification was originally made by W. S. Fisher ("PROCEEDINGS," 13:341, 1949); the breeding habits of this insect are not known.

CHEIRACANTHIUM sp.—Mr. Bianchi reported finding this spider, which has been known to bite man here several times in recent years, at Mapulehu, Molokai, on May 6, 1953. This is a new island record for the spider.

Mr. Maehler reported a recent case of endemic typhus, the first to occur on Oahu in two or three years. The disease is carried by fleas.

CYRTOPELTIS VARIANS (Distant)—Mr. Chilson gave the following report recently received from R. I. Sailer of the U.S. National Museum relative to interception "Hawaii No. 8219": ". . . this is the same species as that treated by Zimmerman "INSECTS OF HAWAII," 3:190, 1948 under the name *Engytatus geniculatus* Reuter, and the use of *C. varians* is not a misidentification as shown by Zimmerman. Zimmerman's usage is based on Usinger's treatment of the species in his paper on the Guam Heteroptera. His conclusions were based on a study of three species and I question the advisability of accepting this change until it is shown that the remaining species can be placed in one or another of the genera as he accepts them. Furthermore, *geniculatus* is a secondary homonym, and, depending upon action of the International Commission of Zoological Nomenclature, might have to be replaced by *varians.*"

TENODERA AUSTRALASIAE (Leach)—Mr. Van Zwaluwenburg reported the unusual abundance of egg cases of this recently established mantid in a macadamia planting at Mokuleia, Oahu. On April 30, a dozen oothecae were collected in a few minutes, and scores more were seen, usually in the upper parts of the trees. This is a new area for this insect on Oahu.

CYRTORHINUS MUNDULUS Breddin—Mr. Verma reported that on April 20 he went to the Campbell farm at Mokuleia to collect corn leafhoppers. He noticed and collected a few leafhoppers in an old crop of corn that had been harvested once, which Dr. Hardy identified as *Perkinsiella saccharicida* Kirkaldy. On April 22, the locality was visited again and about a dozen sugar cane leafhoppers were collected in the same corn field. On a survey of the farm it was noticed that the corn had been sprayed with insecticides and no leafhoppers of any species were to be found except on this particular corn crop, which was the oldest and from which the effects of the insecticide had vanished. Some of the specimens were very teneral and seemed to have molted only a short time before. On examining sugar cane plantings near the farm, he noticed about a dozen individuals of the sugar cane leafhopper in two or three minutes. Adults and nymphs of *Cyrtorhinus* were also noticed on the sugar cane. A few of the adult sugar cane leafhoppers were kept in a cage on corn for about ten days.

This is the first record of the sugar cane leafhopper on corn.

Eggs of the corn leaf hopper in the root of a corn plant about 4 inches away from the soil surface. The eggs have been partly exposed by dissection.

Eggs of the corn leaf hopper in the root of the nut grass, exposed by dissecting the root.

JUNE 8, 1953

The 570th meeting was held at the H.S.P.A. Experiment Station on Monday, June 8, at 2:00 p.m., with President Weber in the chair and F. A. Bianchi as acting secretary.

Members present: Adachi, Barker, Bess, Bianchi, Chilson, Clagg, Du Chanois, Hardy, Haramoto, Hinman, Joyce, Keiser, Look, Messenger, Newell, Rosa, M. Sherman, Stone, Suehiro and Weber.

Visitor: David H. Bixby.

Miss Shizuko Maeda was elected a member and Mr. Bixby was proposed for membership. Mr. William Stone, of the Mexican Fruit Fly Laboratory, spoke briefly on recent work done in Mexico by his organization and others, chiefly the Rockefeller Foundation.

Notes and Exhibitions

Tenodera australasiae (Leach)—Dr. Hardy stated that he was in possession of an ootheca of this insect which was said to have been found near Teacher's College, on the campus of the University of Hawaii.

Nitidulidae spp.—Dr. Hardy reported that during a recent trip to Lanaihale Mt. on the island of Lanai, he had found enormous swarms of what appeared to be the ordinary nitidulids of the lowlands at an elevation of 3,200 ft. above sea level. There was some discussion of their possible origin and manner of migrating.

Neoexaireta spinigera (Wiedemann)—Dr. Hardy reported that this fly was also abundant at the same time and in the same locality as the Nitidulidae.

Caenis nigropunctata Klapalek—Miss Adachi reported the presence of this mayfly in Kaneohe and Waialua, Oahu, on recent dates.

Asteia nudiseta Sabrosky—Miss Adachi reported the finding of this fly in the Koolau Range. It has been known heretofore only from Mt. Kaala.

Anthomyia bisetosa Thomson—Dr. Hardy reported that the correct name for this species should be *illocata* Walker, according to recent information received from C. W. Sabrosky.

Coptotermes formosanus Shiraki—Mr. Clagg reported the presence of these termites at the Kaneohe Marine Corps Air Station, whence they never have been reported previously.

Microlepidoptera—Mr. Clagg stated that on the nights of June 3 and 4 large numbers of a very small black moth had been caught in his light trap in the Pearl City Navy Housing Area. There was some discussion as to whether this might be the same species which is said to be curtailing the production of honey on Hawaii and Kauai through the destruction of the flowers of kiawe (*Prosopis*) on which the larvae are said to feed.

Tropisternus lateralis binotatus Walker—Mr. Bianchi read a note from Mr. Van Zwaluwenburg reporting that Hugh B. Leech of the California Academy of Science had called to his attention the fact that the

proper name for the local variety of this hydrophilid beetle is *T. lateralis binotatus* Walker, not *dorsalis* Brullé, which is preoccupied.

PROCAMBARUS CLARKII (Girard)—A note from N. L. H. Krauss read by Mr. Bianchi stated that specimens of a crayfish collected in taro patches and in a stream in the Kaneohe area in March, 1953, have been determined as this species by Prof. Horton H. Hobbs, Jr., of the University of Virginia. This species has been introduced into the Las Vegas River, Nevada, the Santa Rosa area of California and Japan.

DELTOCEPHALUS SONORUS Ball—Mr. Bianchi read the following note from Mr. Pemberton: A single specimen of this cicadellid was caught in a light trap operated by the H.S.P.A. at Ewa, Oahu, in July, 1952. This is the first record of its occurrence in Hawaii. Since then a few have been caught in the same trap almost every month. On May 20, 1953, many specimens were to be found on Bermuda grass close to the trap at Ewa and at two other points some miles distant. Specimens were sent for determination to Mr. C. F. W. Muesebeck, who replied on May 14 that Dr. D. A. Young had identified the species as above. It was described from Arizona in 1900 (Can. Ent., 32:344). In U.S. Bureau of Entomology Bulletin 108, entitled "Leafhoppers Affecting Cereals, Grasses and Forage Crops," Herbert Osborn discusses this species on pages 79-80. He states that it is present on annual grasses from Florida to southern California and periodically occurs so abundantly in Texas, New Mexico and California as to be of probably economic importance.

JULY 13, 1953

The 571st meeting was held at the H.S.P.A. Experiment Station on Monday, July 13, with President Weber in the chair.

Members present: Adachi, Bess, Bianchi, Chilson, Christenson, Ford, Fullaway, Haramoto, Hinman, Joyce, Look, Newell, Nishida, Rosa, Steiner, Suehiro, Tanada, Tuthill, Van Zwaluwenburg, Verma and Weber.

Visitor: Miss Ruth H. Lippitt.

David H. Bixby was unanimously elected a member of the Society. A clipping from a mainland newspaper was read, announcing the conferring of an honorary degree of Doctor of Science upon Harry S. Smith, an honorary member of this Society, by the University of Nebraska. Miss Ruth Lippitt, who is in the islands to study the comparative morphology of the respiratory structures of dragonfly nymphs, was introduced.

NOTES AND EXHIBITIONS

Dr. Bess remarked on a fly problem which has developed locally because of the extensive use of poultry manure on lawns and flower beds.

NEW HOST RECORDS OF SCALE INSECTS—Mr. Look presented some new hostplant records from collections made on Alewa Heights, Oahu, the insect determinations having been made by Harold Morrison:

Aspidiotus lataniae Signoret; on stems of red ti, August 14, 1952.
Pinnaspis buxi Bouché; on leaves and stems of red ti, August 29, 1952.
Pseudaonidia clavigera Cockerell; on stems of gardenia, August 29, 1952.
Fiorinia fioriniae (Targioni-Tozzetti); on leaves and stems of *Ruta graveolens*, August 8, 1952.

TINEID ATTACKING KIAWE FLOWERS—Mr. Fullaway stated that on May 14, Stephen Au found the small yellowish green caterpillars of an unidentified tineid attacking the florets of kiawe (*Prosopis chilensis*) at Makaweli, Kauai. On May 27 it was reported in kiawe flowers at Puako, Hawaii; later it was found by Rosa and Van Zwaluwenburg near Nanakuli and near Koko Crater, on Oahu, and at Maalaea, Maui, on July 5. Mr. Bianchi said that he had reared the small black adult fly from flowers of "klu" (*Acacia farnesiana*) as well as from *Prosopis*. Mr. Fullaway added that associated with the tineid larvae on kiawe blossoms he had found a new chalcid of the genus *Haltichella*, possibly parasitic upon the caterpillars.

PARASITES OF PLUTELLA—Mr. Fullaway reported that a species of *Horogenes* (Ichneumonidae) and one of *Tetrastichus* (Eulophidae), both parasites of the cabbage moth, were received on February 7 from Dr. R. LePelley, collected at Nairobi, Kenya. These were released soon after their receipt, and on June 29, Q. C. Chock of the Board of Agriculture and Forestry found *Horogenes* established near Waimano Home, Oahu.

CYRTORHINUS LIVIDIPENNIS Reuter—Mr. Fullaway reported that this mirid bug, introduced without success some years ago, was imported again from Guam in several shipments between November, 1952, and January, 1953, to prey on the eggs of the corn leafhopper. On July 3, 1953, it was found in large numbers, and definitely established, at the Kaneohe Hospital, Oahu, by Kai Luke and M. Hironaka.

LIOTHRIPS URICHI Karny—Mr. Fullaway stated that this thrips, imported on April 22, 1953, from Fiji to attack *Clidemia hirta*, the weed newly established on Oahu, was found on June 9 to be established and breeding near Wahiawa, Oahu.

UNKNOWN GALL ON NATIVE BUSH—Mr. Fullaway stated that an undetermined native bush collected July 6 by William Crosby on Molokai had large stem-galls, presumably caused by insects as yet not identified. The globular galls were numerous and in some cases as much as 2 inches long.

PARANDRITA PERKINSI Sharp—This cucujid beetle, collected about 1896 and described (Fauna Hawaiiensis, 3:426, 1908) without hostplant record, was reported by Mr. Ford to have been collected on Kawiwi Ridge at 2,800 ft., on the leeward side of Mt. Kaala on July 16, for the first time since its original capture. Mr. Ford, who exhibited specimens, found it under bark of a large *Acacia koa* branch which had been cut about three weeks before.

LABROCERUS sp.—Mr. Ford exhibited larvae of this dermestid, remarking that almost nothing is known of the immature stages of the genus *Labrocerus*. The larvae he exhibited were found on Kawiwi Ridge on the leeward side of Mt. Kaala, Oahu, on July 16, in a stem of *Bidens*

which had been thoroughly riddled by a variety of other insects. Amid the frass were considerable amounts of larval skins and bits of dead insects; the dermestid larvae were feeding on this material.

CACTOBLASTIS EGGS ATTACKED BY TRICHOGRAMMA—Mr. Van Zwaluwenburg reported that on June 9 he was shown egg sticks of the cactus moth, *Cactoblastis cactorum* (Berg), by H. W. Baybrook of the Parker Ranch, from which he later reared adults of a parasite identified by Mr. Fullaway as *Trichogramma minutum* Riley. The eggs had been collected in the vicinity of Kawaihae, Hawaii, for distribution about the ranch. *Trichogramma* is known to attack *Cactoblastis* eggs in the Argentine and in Australia, but the effectiveness of the moth as an enemy of cactus seems not to be seriously reduced.

CHEIRACANTHIUM sp.—Mr. Van Zwaluwenburg reported finding an adult female of this clubionid spider in a field near Hilo, Hawaii, on June 3. This is the first record of this spider on that island.

PACHYOPTHALMUS ALIENUS Dodge—Mr. Van Zwaluwenburg reported finding a nest of *Sceliphron caementarium* (Drury) at Wainaku, Hilo, on June 2, which contained, in addition to the spiders stocked by the parent *Sceliphron,* several empty puparia and two dead adults of this sarcophagid fly parasite of *Eumenes* and *Sceliphron.* It is a new record for the island of Hawaii. Identification of the fly was confirmed by Dr. Hardy.

BLOWFLIES IN HALEAKALA CRATER—Dr. Joyce reported that on a recent trip into the crater with Dr. Hardy, they had noted a considerable number of calliphorid flies, probably bred in goats killed by hunters and left to die in the field. At Paliku, at an elevation of 6,500 ft., the three most common species were *Calliphora vomitoria* L., *Phormia regina* (Meigen), and *Eucalliphora lilaea* (Walker). This combination of species is different from the species usually dominant at lower elevations in Hawaii.

SPILONOTA HOLOTEPHRAS Meyrick—Mr. Steiner, reporting on his recent trip to the Marianas, stated that in about 1936 it was thought that the guava trees on Guam were on the decline because of the work of this tortricid moth, which feeds on the buds and new leaves. Mr. Steiner's observations on Guam, Rota and Tinian lead him to believe that the guava is far from declining, as many of the trees were bearing fruit.

AUGUST 10, 1953

The 572nd meeting was held at the H.S.P.A. Experiment Station on Monday, August 10, at 2:00 p.m., with President Weber in the chair.

Members present: Adachi, Balock, Barker, Bess, Bianchi, Clagg, Chong, Ford, Fullaway, Haramoto, Keiser, Look, Maeda, Maehler, Messenger, Newell, Rosa, M. Sherman, Steiner, Tanada, Tuthill, Van Zwaluwenburg, Weber and Yasuda.

Visitor: Dr. R. Namba.

Dr. Namba, a graduate of the University of Minnesota in entomology, was introduced and made a few appropriate remarks. Charles Yasuda, a

member who has just returned from active service in Korea, was welcomed back.

Paper

Mr. Steiner presented by title a paper by Edgar Dresner: "Observations on the Biology and Habits of Pupal Parasites of the Oriental Fruit Fly."

Notes and Exhibitions

Anoplolepis longipes (Jerdon)—Mr. Clagg reported that specimens of this ant were collected at the Naval Supply Center, Pearl Harbor, Oahu, in December, 1950. The earliest previous record for this insect was April, 1952, when Mr. Ford found the ant at Barber's Point, Oahu ("Proceedings," 15:10, 1953). Mr. Clagg exhibited pest control handbooks issued by the Navy to its personnel.

Eurytoma tephritidis Fullaway—Dr. Bess stated that this eurytomid parasite of the pamakani gall fly which was described ("Proceedings," 15:33, 1953) from Oahu, also occurs on Maui, Molokai and Lanai. Specimens from those islands have been identified as this species by Mr. Fullaway.

Tetrastichus nr. sokolowskii Kurjudmov—Miss Chong reported that this parasite of the diamondback cabbage moth, imported from Nairobi, East Africa, in May, 1953, is now established on Oahu. Mr. Harry Nakao of the Board of Agriculture and Forestry collected host larvae on broccoli at the Waimano Home farm on July 26, and reared over 50 *Tetrastichus* from the material. Identification was made by B. D. Burks of the U. S. National Museum.

Corythuca morrilli Osborn and Drake—For Dr. Hardy it was reported that this tingid bug, new to the Territory, was reported from Lualualei, Oahu, on July 24. A survey led by Dr. Hardy found the insect breeding on cockleburr (*Xanthium* sp.), *Verbesina encelioides* and *Ambrosia artemisiaefolia*, with cockleburr definitely preferred. The insect was found to occur from Makaha Valley, through Waianae and Brown's Camp, along the railroad as far as Ewa mill, and on the Kunia road. Mr. Bianchi added that he later found this tingid on *Verbesina* at Mokuleia, Oahu. It was described in Ohio Jour. Sci., 17:298, 1917. Identification was confirmed by H. G. Barber of the U.S. National Museum.

Cheiracanthium sp.—Mr. Ford spoke of a man who was bitten by this spider recently within the terminal building at the Honolulu Airport. A swelling quickly developed at the site of the bite on the hand and itching lasted for about 20 minutes.

Protaetia fusca (Herbst)—Mr. Maehler told of observing this beetle feeding on nectar of white ginger at Kahala, Honolulu.

Scolia ruficornis F.—Mr. Van Zwaluwenburg stated that Mr. Owen had taken an adult of this parasite of the coconut beetle (*Oryctes rhinoceros* L.) on Koror in the Palau Islands early in August. This is definite proof of the establishment of this *Scolia* on Koror; it was last released on Babelthuap, five miles from Koror, in December, 1951.

TILLUS NOTATUS Klug—Mr. Van Zwaluwenburg reported finding this clerid beetle in some numbers on young cane plants at Lahaina, Maui; this is a new island record. This beetle, which occurs in Madagascar, Burma, the East Indies, China, the Philippines, Japan, Guam and the Moluccas, was first taken locally on flowers by Miss Suehiro in 1939 on the University of Hawaii campus. Later, Mr. Weber reported rearing it from wood of *Leucaena glauca* infested by bostrichids, and it was found resting on bean plants by Holdaway and Look.

RODOLIA CARDINALIS (Mulsant)—Mr. Bianchi reported that of some 270 adults and pupae of this ladybird beetle sent by him and Mr. Rosa to Tutuila, Samoa, on July 13, 33 arrived alive and began feeding voraciously on *Icerya aegyptiaca* (Douglas) on breadfruit.

LIOTHRIPS URICHI Karny—Mr. Fullaway exhibited potted plants of *Clidemia hirta* infested by this recently introduced and established thrips. Damage to the plants develops very soon after infestation by the thrips.

ANT BITING SWIMMERS—Dr. Tuthill spoke of ants, apparently carried offshore by wind and deposited on the water, biting swimmers at a windward Oahu beach.

SEPTEMBER 14, 1953

The 573rd meeting was held at the H.S.P.A. Experiment Station on Monday, September 14, at 2:00 p.m., with President Weber in the chair and F. A. Bianchi as acting secretary.

Members present: Adachi, Bianchi, Chong, Chilson, Clagg, Fullaway, Ford, Hardy, Look, Maehler, Newell, Nishida, Rosa, Steiner, M. Sherman, Stilton, Sakimura, Tuthill and Weber.

Visitors: R. Namba, Donald R. Johnson.

Mr. Donald Johnson, en route from Indonesia to America, was introduced by Dr. Steiner. Dr. Namba was proposed for membership in the Society. Dr. Hardy was unanimously elected to represent the Society in the affiliation committee of the Hawaiian Academy of Science.

PAPER

Mr. K. Sakimura presented by title his paper: "A New Scolothrips from Hawaii."

NOTES AND EXHIBITIONS

Mr. Clagg read excerpts from a recent article in "SCIENCE" on the toxicity of chlordane vapors, and much discussion of the subject ensued.

ZATROPIS TORTRICIDIS Crawford—Mr. Fullaway stated that specimens of this pteromalid parasite had been obtained in the laboratory from kiawe branches, infested by the recently established tineid kiawe moth, that had been collected by him at Makapuu, Oahu, during September, and by Mr. Van Zwaluwenburg at Waikapu, Maui, during August.

Trissolcus murgantiae Ashmead—Mr. Fullaway reported that this scelionid parasite, introduced in 1946, had been reared from harlequin bug eggs collected at Waianae, Oahu, during August. This is the first recovery of this parasite.

Kiawe moth—Mr. Fullaway stated that according to word just received from Dr. J. F. G. Clarke of the U.S. National Museum, the kiawe moth recently found in the Territory is probably a new species, and possibly a new genus and family.

Lasioderma serricorne (F.)—Mr. Ford spoke of a heavy infestation of this anobiid found by him at the Honolulu Airport on August 19. The beetles had almost completely consumed the contents of jars containing chili pepper, celery seed, poultry seasoning, potato flour and summer savory. A jar of summer savory was exhibited at the meeting.

Dermestes spp. new to Hawaii—Mr. Ford exhibited specimens of *Dermestes* (?)*unicolor* Lepesme, *Dermestes frischii* Kugelann, and *Dermestes* sp., all determined by Hugh B. Leech of the California Academy of Sciences, and collected by Mr. Ford under dead chickens at Damon Tract, Honolulu, during May, 1953.

Blapstinus sp. and **Hypophloeus** sp.—Mr. Ford also exhibited specimens of these tenebrionid beetles, also determined by Mr. Leech and constituting new records for the Territory. *Blapstinus* was first collected by Ford at Waikiki, Honolulu, in January, 1949, and has been found by him later at Barber's Point, Waianae, and Damon Tract. *Hypophloeus* was collected at Moanalua Gardens, Honolulu, in the borings of *Xystrocera globosa* Olivier in January, 1953.

Tenodera australasiae (Leach)—For Dr. Tanada, Dr. Hardy exhibited an ootheca of this mantid which had been collected on the University campus. This record extends the known range of this mantid with certainty, a previous record from the same locality being doubtful.

Stenopalmatus longispina Brunner—A living specimen of this tettigoniid insect, the well-known Jerusalem cricket of the southwestern U.S., was exhibited by Mr. Chilson. It had been found crawling on the floor of a building at Hickam Field, Oahu, on August 14. It had probably crawled out of recently arrived baggage or freight and is not thought to be established in the Territory.

Corythuca morrilli Osborn and Drake—Mr. Fullaway stated that recent tests made by the Board of Agriculture and Forestry show that this newly immigrant insect will feed on garden beans and *Chrysanthemum*. Mr. Bianchi stated that a recent survey made by Messrs. Van Zwaluwenburg, Rosa and Bianchi had shown the presence of this tingid on cockleburr between Makapuu Head and Waimanalo, but not between Makapuu Head and Honolulu.

Lithurgus scabrosus (Smith)—Mr. Bianchi spoke of finding a large number of these megachilid bees making nests in a dead branch of an unidentified tree near Wailua Falls, Kauai, on August 19. This bee has been known from Oahu since 1900, but the present record appears to be the first from the island of Kauai.

AMMOPHORUS INSULARIS Boheman—Mr. Van Zwaluwenburg called attention to a recent publication ("*The Coleoptera of the Galapagos Islands*," Occ. Papers Calif. Acad. Sci., No. XXII, 1953) in which the late Dr. E. C. Van Dyke discusses this tenebrionid beetle. The genus is well represented in the Galapagos, and *insularis*, described from Oahu in 1858, occurs on Chatham and South Albermarle Islands. Dr. Van Dyke suggests that it was brought to Oahu from Chatham in ballast by whaling ships early in the nineteenth century. The statement that the species is localized in the vicinity of Waikiki, Oahu, is no longer true, for specimens were taken by Dr. Swezey at Gilbert, west of Ewa, in 1925, at Koko Crater in 1932, and at Barber's Point in 1940. It was a "lost" species between the time of its first capture at Honolulu in the summer of 1852[2] by the naturalist (probably Anderson) of the Swedish frigate "Eugenie," and its rediscovery by Horace Sharp at Kaimuki on April 5, 1920. Blackburn's and Perkins' failure to find this species is rather surprising. *A. insularis* is present in the H.S.P.A. collection from the following islands in addition to Oahu: South Point, Hawaii (1951); Hawaiian Commercial & Sugar Co's plantation, Maui (1934), and Mapulehu, Molokai (1949).

Dr. Hardy and Mr. Bianchi discussed general entomological and botanical observations which they had made on the island of Kauai during the early part of this month. Mr. Bianchi pointed out that the Himalayan blackberry and *Myrica faya*, the firebush, have spread and increased alarmingly in the Kokee area since his last visit there six years ago.

Mr. Chilson presented the following notes:

LOBOMETOPON DIREMPTUS (Karsh). According to R. H. Arnett, this is the correct name for the tenebrionid previously known in the genus *Epitragus*.

ATTAGENUS UNDULATUS (Motschulsky). Mr. W. H. Anderson makes this correction in the generic name of the dermestid known here as *Telopes undulata*.

GONOCEPHALUM SERIATUM (Boisduval). This was collected on Johnston Island on June 1, 1952, by K. L. Maehler and is a new locality record.

MITRASTETHUS BROUNI Faust. According to R. E. Warner this is the correct name for *Mirastethus bituberculatus* (F.) ("PROCEEDINGS," 10:135, 1938). Warner says that *bituberculatus* is a name long used in error—a point not discovered by Zimmerman until after his paper was in print. This weevil was described in the Stettiner entomologische zeitung, 1889, p. 72.

TAENIOTHRIPS VITTICORNIS (Karny). This thrips, new to the Territory, was found on outgoing gardenia flowers and a mauna loa (*Canavalia microcarpa*) lei at the Honolulu Airport by E. H. Davidson and H. A. Woolford on June 28, 1952. It was described in Jour. Siam. Soc., 16:103, 1923. Identification was made by Miss Kellie O'Neill.

HAEMOLAELAPS MEGAVENTRALIS (Strandtmann). This laelaptid mite, new to the Territory, was collected during export inspection under the

[2] Miss Bernice Judd, librarian of the Hawaiian Mission Children's Society, kindly supplied the information that the "Eugenie" came to Honolulu in 1852, making two visits, one from June 22 to July 3, and the other from August 25 to August 27.

cap of a coconut being taken back to the mainland on January 8, 1953, by L. M. Chilson. This mite was previously known from the southern and eastern states. It was collected during typhus surveys on squirrels, rats, mice, and various birds.

OCTOBER 12, 1953

The 574th meeting was held at the H.S.P.A. Experiment Station on Monday, October 12, at 2:00 p.m., with President Weber in the chair.

Members present: Adachi, Bess, Bianchi, Carter, Chong, Christenson, Clagg, Du Chanois, Flitters, Fullaway, Ford, Gressitt, Hardy, Hu, Joyce, Keck, Keiser, Maeda, Newell, Nishida, Pemberton, Rosa, Sakimura, M. Sherman, Steiner, Suehiro, Tanada, Van Zwaluwenburg, Verma and Weber.

Visitors: C. P. Clausen and E. F. Bashor.

Dr. R. Namba was unanimously elected a member of the Society and C. P. Clausen was nominated for membership.

Paper

Mr. Ford presented his paper "The Genus Xyletobius on Oahu, with Descriptions of New Species (Coleoptera: Anobiidae)"; and Dr. Hardy presented by title "Notes and Descriptions of Australian Fruit Flies (Diptera: Tephritidae)."

Notes and Exhibitions

Mr. Keck exhibited a piece of Douglas fir badly infested with *Coptotermes formosanus* Shiraki; this was to demonstrate the ineffectiveness of surface applications of 5 per cent pentachlorphenol which had been made to this wood about a year before. After a discussion concerning proposed changes in the municipal building code a committee was appointed to look into the proposal and report back to the Society at the next meeting. Appointed to this committee were Dr. Bess, Dr. Sherman, and Mr. Keck.

Anoplolepis longipes (Jerdon)—Mr. Clagg reported the presence of this recently established ant in Navy Housing Area III.

Fruit flies—Mr. Steiner submitted the following: An interesting comment relative to fruit flies has come to our attention. It was made by W. W. Froggatt in 1909 in his "Report on Parasitic and Injurious Insects for 1907-1908," published by the Department of Agriculture, New South Wales. After calling attention to the discovery by Howlett of the attraction of citronella oil to a fruit fly which he called *Dacus ferrugineus* he states: "One remarkable thing was that when we came to examine them we found that all the specimens were males. Further experiments right through the season should prove whether this is always the same, but even so, the destruction of all the males would soon lead to infertile females. If other oils can be found to attract other species, they can be mixed with

poison or used in traps and will become very effective in controlling the pest."

Apparently this idea was never followed up. Neither Froggatt nor Howlett observed that the flies consumed citronella. It contains fractions that inhibit feeding so that the flies feed far less avidly than on methyl eugenol. This fact plus the general unavailability in 1907 of quick-acting, highly toxic poisons that would insure kill with a minimum of consumption would probably have prevented sufficient male annihilation to effect any noticeable control. Even with our present available poisons, citronella is a very poor attractant for poison bait-station use against *D. dorsalis.*

EUPELMUS CUSHMANI (Crawford)—Dr. Pemberton reported rearing this eupelmid from a larva of the anthribid *Araecerus fasciculatus* (DeGeer) found in a dry seed of *Bumelia* sp. in Honolulu on September 28. Though this insect has been previously recorded as a parasite of *A. fasciculatus* on the mainland United States, this is apparently the first time it has been observed parasitizing an anthribid in Hawaii.

SCAPHYTOPIUS LORICATUS (Van Duzee)—Two specimens of this cicadellid leafhopper were exhibited by Dr. Joyce. They were taken in a light trap August 17 at the Public Health Quarantine Station in Honolulu. Another specimen was taken in the trap on August 19. Identification was made by Dr. D. A. Young of the U.S. National Museum. This is a new record for these Islands. The North American distribution of this insect includes California, Arizona, and Texas. As far as known it is of no particular importance there.

GONIOPHYTO BRYANI Souza Lopes—On September 16 a specimen of this sarcophagid fly was taken in a light trap at the Quarantine Station by Dr. Joyce. Although this is a common species on the leeward islands of the Hawaiian chain, this is the first time it has been taken on Oahu.

Dr. Gressitt, recently returned from a trip to Europe, told of some of the decisions made by the Zoological Congress with respect to the Code of Nomenclature. He mentioned the excellence of a new book on entomological illustrating, "INSECTS CLOSE UP," by Dr. E. S. Ross of the California Academy of Sciences.

CHLORION THOMAE (F.)—Mr. Bianchi exhibited specimens of this neotropical fossorial wasp first collected by him on August 3 along the margin of Kaelepulu Pond in Kailua, Oahu. On September 23 he and Mr. Weber collected six females and 46 males in the same locality. This is a new species for the Territory. On September 23 both sexes were found flying rapidly in and out of a dense cover of Bermuda grass, with the females occasionally stopping to feed on the flowers of *Pluchea* or *Sesuvium.* Later Mr. Weber observed a female carrying an adult of the acridid *Oxya chinensis* (Thunberg).

CHEIRACANTHIUM sp.—Mr. Bianchi exhibited a male and a female of this poisonous spider, taken by him in ground litter at Kokee, Kauai, on August 15. This appears to be a new island record for this spider.

MEGOPIS (AEGOSOMA) REFLEXA (Karsch)—Mr. Ford exhibited three adult females and one male of this prionid, the largest endemic coleop-

teron known here. The specimens were taken in a dead stump of *Metrosideros polymorpha* on the Kawailoa trail, Oahu. One female lived for five days, during which time she deposited 39 eggs. Both eggs and a pupal cell in ohia wood were exhibited. This appears to be the first recorded capture of adults of this beetle since 1918.

Dr. Carter spoke of his work for the Food and Agricultural Organization of the United Nations in Ceylon. Cacao has a mild virus disease perhaps akin to the more virulent "swollen shoot" disease of the Gold Coast and, like it, having a reservoir in surrounding forest trees. *Helopeltis* bugs are a severe problem in cacao groves at times. Chili peppers, an important local crop, have their own complex of insects. Rice, except for the problem of stem borers, appears to enjoy fairly satisfactory insect control.

APANTELES BEDELLIAE Viereck—Mr. Fullaway exhibited specimens of this braconid bred from *Bedellia* obtained on morning glory at Lanikai, Oahu, in October, 1953, showing that this parasite, introduced in 1945, is well established here.

The program closed with the exhibition by Mr. Flitters of his excellent Kodachrome movies of some of the commoner insects in Hawaii. Life history sequences were shown of the monarch butterfly, the black witch moth, *Achaea janata* (L.), eumenid wasps and several other insects.

NOVEMBER 9, 1953

The 575th meeting was held at the H.S.P.A. Experiment Station on Monday, November 9, at 2:00 p.m., with President Weber in the chair.

Members present: Adachi, Bianchi, Chilson, Chong, Clagg, Du Chanois, Ford, Fullaway, Gressitt, Hinman, Joyce, Keck, Look, Messenger, P. Nakagawa, Nishida, Rosa, M. Sherman, Steiner, Suehiro, Tuthill, Van Zwaluwenburg and Weber.

Dr. C. P. Clausen was unanimously elected to membership in the Society.

The committee appointed to suggest changes in the building code with respect to termites reported that it would be ready to report at the January meeting, having received assurance from City and County officials that the code will not be changed until after that date.

NOTES AND EXHIBITIONS

TENODERA AUSTRALASIAE (Leach)—Mr. Keck reported that a characteristic ootheca of this mantid was found at Aina Haina, Honolulu, on November 1; this is a considerable extension eastward of the known range of this recent immigrant.

CHEIRACANTHIUM sp.—Dr. Sherman reported a suspected case of bite by this spider. Mrs. Sherman was bitten on the hand; an irritated area about one-quarter inch in diameter resulted, with acute stinging pains running up the arm to the elbow. After a few hours the pain disappeared with no after-effects.

TEREDO INJURY—Mr. Ford exhibited for identification a piece of driftwood found on the beach which contained many holes. These were thought by members to be due to damage by these marine mollusks.

PERKINSIELLA VITIENSIS Kirkaldy—Mr. Chilson reported that the second heaviest infestation of this leafhopper on a plane arriving from Fiji was found by Mr. Ford at Honolulu Airport on June 17. The insects were very numerous; they were identified by D. A. Young of the U.S. National Museum.

POLIDIDUS ARMATISSIMUS Stal—Mr. Chilson exhibited a number of adults of this reduviid bug collected in a house at Pahoa, Hawaii, by Richard Sato on August 31. This is a new insect for the Territory. Identification was made by Dr. C. E. Pemberton by comparing specimens with named material in the H.S.P.A. collection. The insect occurs in Fiji as well as in the Philippines, Japan, China, and westward to Ceylon and India.

POLISTES EXCLAMANS EXCLAMANS Viereck—In a discussion of the spread of this vespid wasp on Oahu, Mr. Ford brought out the fact, until now unrecorded, that it is present at Barber's Point Naval Air Station. This is the farthest west the species has been found on this island.

DECEMBER 14, 1953

The 576th meeting was held at the H.S.P.A. Experiment Station on Monday, December 14, at 2:00 p.m., with President Weber in the chair.

Members present: Adachi, Balock, Barker, Bess, Bianchi, Carter, Chilson, Chong, Du Chanois, Ford, Hardy, Ito, Look, Newell, Nishida, Pemberton, Rosa, Sakimura, M. Sherman, Suehiro, Tanada, Tuthill, Van Zwaluwenburg and Weber.

Visitor: James Patterson.

The following officers were elected for the coming year:

President	L. F. Steiner
Vice-President	J. L. Gressitt
Secretary-Treasurer	F. A. Bianchi
Members of Executive Committee	P. W. Weber
	M. Sherman

In the absence of both the President-elect and the Vice-President-elect, Mr. Weber asked Dr. Tuthill to take the chair while he delivered the annual address of the retiring President, entitled "Studies on the Giant African Snail." At the conclusion of the address an interesting discussion followed on some of the points brought up in Mr. Weber's paper.

PAPER

Miss Adachi presented her paper by title: "Preliminary Studies in Hawaiian Dolichopodidae. Part II. The Genus Emperoptera Grimshaw."

Notes and Exhibitions

Parasites of the native owl—Miss Adachi exhibited a collection of parasites collected from the "pueo" or native owl (*Asio flammea sandwichensis*). The bird had been injured by an automobile and was alive when brought in for examination. The hippoboscid fly,*Ornithoica pusilla* (Schiner), was found in great numbers around the head, especially in the ears, where the flies were probably breeding. Several puparia, as well as a large series of males and females, were collected from the ears. There was also a heavy infestation of lice, *Colpocephalum brachysomum* Kellogg and Chapman. The identifications are tentative, and specimens have been sent to specialists for verification.

Unidentified woody galls—Dr. Hardy exhibited several galls in woody branches of an unidentified tree or shrub from Kauai. The galls were round in general and varied in size from about one-half inch to over two inches in diameter. Cross sections of some of the material gave no indication as to the cause of the malformations, and the insect involved, if it is an insect, remains unknown.

Prosthetochaeta fasciata Grimshaw—Dr. Hardy called attention to a feature of the life history of this calliphorid fly which is most unusual in the family. The female gives birth to a mature maggot which soon forms a puparium much as hippoboscid flies do. *P. fasciata* is fairly abundant at elevations of over 3,000 feet, both at Kilauea, Hawaii, and in the Kokee region of Kauai.

Dr. Hardy discussed the matter of bringing up-to-date the common names list of Hawaiian insects, a project which seems to have lapsed after a period of interest some ten years ago. Chairman Tuthill requested Dr. Hardy to appoint and head a committee to revive the project.

Apion ulicis L.—In reply to a question, Mr. Weber stated that this gorse weevil had been liberated last in January, 1952, near Humuula, Hawaii, and that adults had been seen in the same locality in July, 1953. However, he pointed out that it is by no means certain that the individuals collected in 1953 were not some released some months before.

Protaetia fusca (Herbst)—Mr. Weber reported an unusual type of damage by this cetoniid beetle. He observed the adults consuming the leaflets of *Poinciana* trees at Waialae Ranch on Oahu. Heretofore this beetle has been reported to feed on flower blossoms of various kinds, on corn silk, and on rose buds.

Dr. Pemberton and Dr. Bess reported on the 8th Pacific Science Congress recently held in Manila. The meetings were well attended and entomological interest centered on the work in the Pacific on the coconut rhinoceros beetle and the giant African snail.

Dr. Carter and Dr. Hardy gave an account of the meetings in Los Angeles of the Entomological Society of America, which they attended. It was the first gathering of the newly amalgamated societies, and there was a great number of interesting papers.

DACUS DORSALIS Hendel—Mr. Steiner presented the following note on the abundance of oriental fruit flies in the Mariana Islands. On Guam, in June, 1953, a series of 44 plastic invaginated traps baited with methyl eugenol and a poison caught 3,260 oriental fruit flies, *Dacus dorsalis* Hendel, or 9 flies per trap-day. The traps were evenly distributed over the island. Catches were heaviest, 460 and 1,120 flies, respectively, at Urono and Taguan Points in "boondock" areas in north Guam. Approximately 80 per cent of the traps caught flies.

George D. Peterson continued operation of the traps on Guam through most of July and August. With the advent of the rainy season late in June, the catch increased to 54 flies per trap-day; in July it was 98, and in August, 43. He has taken more than 115,000 males since June.

On Saipan 20 traps caught an average of 36 oriental fruit flies per trap-day. Officials and farmers reported that they had reached the peak of their abundance on Saipan in 1951, when "mangoes were 100 per cent infested." On Rota 10 traps caught 1,280 of these flies in less than 24 hours. One picked mango was found to contain 30 nearly mature larvae. Several ovipositing females were seen.

No parasites were observed on any of the Mariana Islands. The principal hosts observed were wild papayas growing on jungle-covered abandoned farm land, and mangoes, breadfruit, avocado, and banana.

SPILONOTA HOLOTEPHRAS Meyrick—The bud moth *Spilonota holotephras* Meyrick has been credited with the biological control of guava, *Psidium guajava*, in the Mariana Islands, and the desirability of introducing this insect into Hawaii for this purpose has been considered several times. In June 1953 Mr. Steiner observed at least 150 guava trees in the Agana Heights residential area on Guam. These trees ranged up to 15 feet in height, and some appeared to be 6 to 10 years old. None was seen in other parts of the island. Nearly all had good crops of fruit ranging from ½ inch in diameter to mature.

Larvae, which appeared to be *Spilonota* on the basis of the type of injury, were present on nearly every guava plant. The injury was somewhat typical of that caused by a leaf roller, *Amorbia emigratella* Busck, in Hawaii. Many buds were attacked, but the damage was most severe to the older leaves near the terminals. The abundance of fruit provided clear-cut evidence that the insect had not prevented heavy fruiting. On the contrary, there were some indications that, by restricting terminal growth, it may actually have increased the fruiting potential.

On Rota the only guava plant seen was located on the highest elevation (1600 feet). This plant was also infested with the bud moth, but nevertheless it bore a heavy crop. On Saipan several fruiting guava plants of different ages, all with bud moth infestations, were observed.

These observations suggest that the reasons for the low incidence of guava trees in the Marianas need further study before introduction of *Spilonota* into Hawaii is seriously considered.

Preliminary Studies in Hawaiian Dolichopodidae (Diptera) Part II. The Genus Emperoptera Grimshaw[1]

By MARIAN S. ADACHI

UNIVERSITY OF HAWAII
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

The genus *Emperoptera* was erected by Grimshaw (1913:81) for a species of flightless dolichopodid which had been collected by Dr. R. C. L. Perkins in the Koolau Mountains, Oahu, in 1900. The species has not been recovered since then and Zimmerman (1948:153) stated that "It appears that this remarkable fly is now extinct—at least in the type locality—because it was unable to withstand the new pressure created by the invasion of its environment by immigrant predaceous ants." Such a monotypic genus with a "biological freak" for its genotype would make one skeptical of its status. However, Zimmerman (1938:145) described a second species which he collected on the northwest slopes of Mt. Haleakala, Maui. Two additional species were found last summer on the mountains of Molokai and Maui. A large series of one was collected at Puu o Kaeha and vicinity, Molokai, by D. E. Hardy and M. Tamashiro; a description of this species is included in this paper. The other species was collected on Puu Kukui, west Maui, by R. C. Joyce; it is a unique and will be described later when more specimens are available.

The presence of at least four species of these peculiar flies which are geographically isolated on various parts of the Hawaiian Islands gives rise to some interesting speculations with regards to their evolutionary development. From a comparative study of their structural details, it appears that they have arisen from four different ancestral stocks in the genus *Campsicnemus* Haliday.

Grimshaw considered *Emperoptera* as being related to *Chrysotus* Meigen. It is obvious, however, that *Emperoptera* is more closely related to *Campsicnemus* Haliday. Both have the abdomen compressed dorsoventrally; the third antennal segment pubescent, short, and triangular with a long, pubescent, dorsal arista; and the male hypopygium small, inconspicuous, and partially hidden. *Emperoptera* differs from *Campsicnemus* by having the wings reduced to a slender lanceolate appendage (fig. 1), and by having only three pairs of dorsocentral bristles, and no acrosticals on the mesonotum (fig. 8). Also, in many species of *Campsicnemus*, the males of the known *Emperoptera* have the middle legs ornate.

In *Emperoptera*, the front, above the antennae, is triangular, the vertex forming the base. The face, below the antennae, is narrowed in the middle to the width of one eye facet in the females; in the males the eyes are contiguous for the length of five to six eye facets. The eyes are covered with short, pale pubescence. The bristles on the head consist of a

[1] Published with the approval of the Director of the Hawaii Agricultural Experiment Station as Technical Paper No. 309.

pair of long, well developed, proclinate, outer verticals; a pair of strong ocellars; a weak pair of postocellars, and a row of occipitals. The pronotum forms a collar-like sclerite around the neck and bears a row of short black bristles. The mesonotum is twice as long as wide with three pairs of dorsocentral bristles. Two of the three pairs are located anteriorly and the other adjacent to the scutellum. The distance between the prescutellar pair and the hindmost pair of anterior dorsocentrals is almost twice the distance between the two anterior pairs. The humeri each have two distinct bristles and one hair-like seta. The uppermost humeral bristle is large, very long, and curved inward; the other is smaller, about one-fourth the size of the former. There are two notopleural bristles—a strong anterior and a weaker posterior one. The posthumeral, anterior supra-alar, and postalar pairs of bristles are also well developed. The postalar bristles are alined horizontally with the posterior pair of dorsocentral bristles (fig. 8). The scutellum is one and a half times as wide as long, rounded on the hind margin and has two bristles.

The wings are narrow (fig. 2), the width is considerably reduced, but are of normal length. The costal margin is normal and a strong bristle is present near the base of the costa, as found in the *Campsicnemus* wing.

The abdomen is flattened dorsoventrally and from a dorsal view, six segments are visible in the males and five in the females. The male hypopygium is very inconspicuous and partially hidden under the sixth tergum. *In situ,* the seventh and eighth segments are not visible, only part of the ninth and the cerci can be seen.

Genotype: *Emperoptera mirabilis* Grimshaw.

Key to the Known Species of Emperoptera

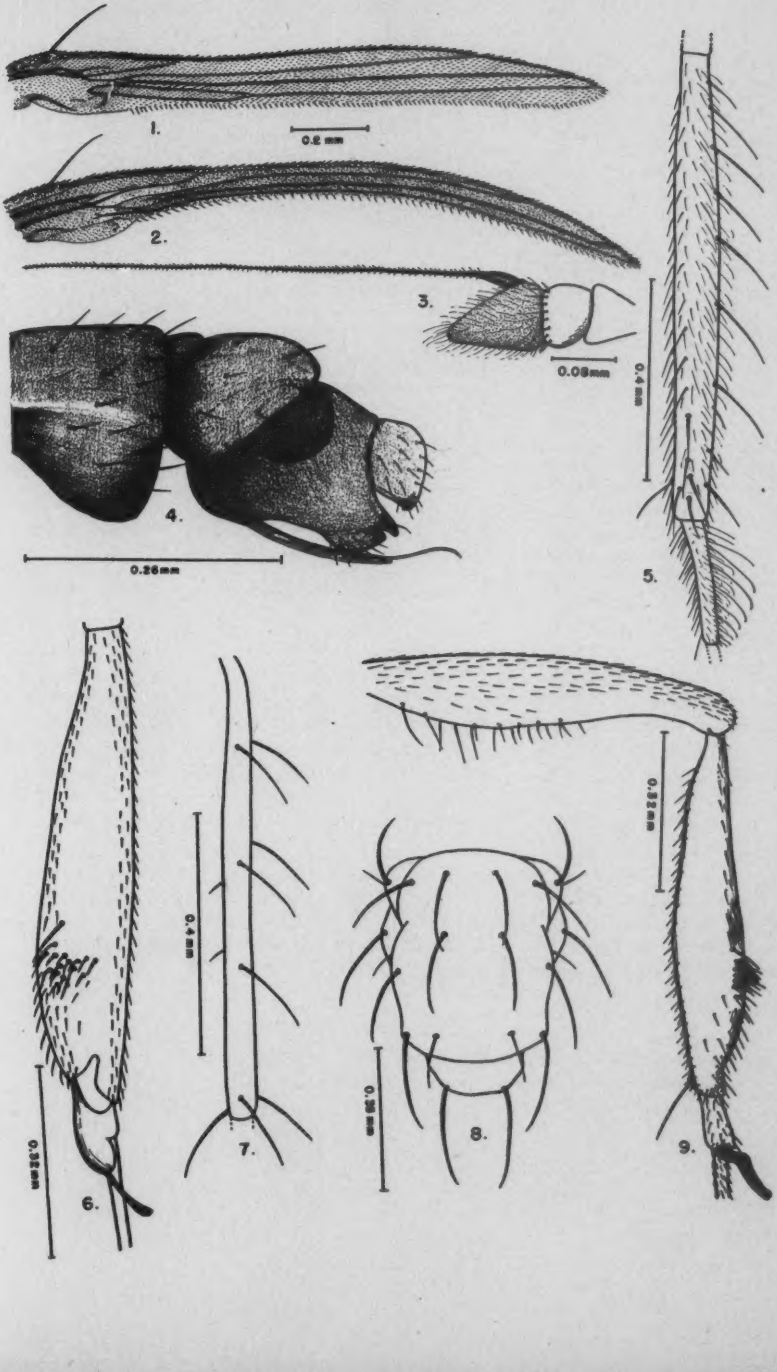
1. Wings with a well developed apical bristle; middle tibia with four bristles ..... **mirabilis** Grimshaw
   Wings without apical bristles; middle tibia not as above 2
2. Middle tibia slender, not enlarged, with seven long bristles on the posterior margin; middle basitarsus with a row of long, hair-like bristles (fig. 5); Vein M_{3+4} absent (fig. 2) ..... **haleakalaae** Zimmerman
   Middle tibia enlarged, with a patch of short, stout bristles on the apical fifth; middle basitarsus with a large, truncate, apical spur (fig. 9); vein M_{1+2} separate from vein M_{3+4}, at least at base (fig. 1) ..... **bryophila** new species

Emperoptera bryophila new species

Male. *Head:* The vertex and front are dark brown with bronze pollinosity. The first two segments of the antennae are yellow; the second segment has an apical crown of black bristles; the third segment is brown pubescent, triangular, and scarcely longer than the second (fig. 3). *Thorax:* The mesonotum is brown to bronze with a slight iridescence. The anterior pairs of dorsocentrals are much more developed than the hind pair. The pleura is concolorous with the mesonotum except for most of the sternopleura and hypopleura which are pale yellow. The scutellum has a pair of marginal bristles and is concolorous with the mesonotum. *Wing:* The wings are brown fumose.

EXPLANATION OF FIGURES

E. bryophila n.sp.: Fig. 1. wing; Fig. 3. antenna of male; Fig. 4. extended male genitalia; Fig. 6. mesotibia of male, dorsal view; Fig. 7. hind tibia of female, anterodorsal view; Fig. 8. mesonotum, dorsal view; Fig. 9. lateral view of middle femur, tibia, and basitarsus. **E. haleakalaae** Zimm.: Fig. 2. wing; Fig. 5. dorsal view of middle tibia.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0.25mm
9.

The subcosta is incomplete and R_{1+2} ends in the costa at the basal one-fourth of the wing. Veins R_{1+2}, R_{3+4} and M are relatively straight and are almost parallel. The M veins are differentiated at their bases and form a loop (fig. 1). M_{1+2} continues to the wing margin. The free end of the M vein is more than twice the length of the looped base. The halteres are yellow. *Legs:* Yellow. Forelegs without strong bristles; the tibia is about three-fourths the femur; the basitarsus is long and equal to the following two segments. The middle leg, especially the tibia, is greatly modified; on the basal half of the femur, there is a row of ventral bristles which gradually shorten distally (fig. 9); the enlarged tibia is cleft at the apex and is slightly longer than the femur, with rows of setae on both sides of the dorsum leaving the central portion mostly bare except for a large patch of short, stout, black bristles situated at the apical fifth (fig. 6), and with a large preapical bristle on the venter; the basitarsus is very small, about the length of the last tarsal segment, terminating in a large truncate spur (fig. 9). The hind legs are normal; the femur is four-fifths as long as the tibia with a well developed preapical bristle on the anterior surface; the tibia with four anterodorsal, three or four posterodorsal, and three ventral bristles; the basitarsus is about two-thirds the length of the second tarsal segment and slightly longer than the third. *Abdomen:* Dark brown. The hypopygium consists of segments seven, eight, and nine. The seventh is reduced to a narrow strip and cannot be seen *in situ*. The eighth segment forms a scale-like plate over the foramen on one side of the ninth. The ninth segment is rather large and can be seen *in situ*. It has a pair of ventral lobes at the apex on each side, the tips of which are heavily sclerotized, and the sheath of the penis arises at the base of the ninth. The cerci are comparatively large and conspicuous.

Length: body and wing, 1.5-2 mm.

Female. As in the males except for the shorter third antennal segment, the genitalia, and the following details of the legs. The front tibia has one dorsal bristle; the middle tibia has four anterodorsal, two posterodorsal, and three ventral bristles; the hind tibia has four anterodorsal, three posterodorsal, and three ventral bristles (fig. 7).

Holotype male and allotype female from Puu o Kaeha, Molokai, 3700 ft. elevation, July, 1953 (D. E. Hardy and M. Tamashiro). Paratypes: 51 males and 52 females, same data as type, and others from Hanalilolilo, Molokai, 4000 ft. elevation, July, 1953 (Hardy and Tamashiro), and Puu Alii, Molokai, 4200 ft. elevation, July, 1953 (Hardy and Tamashiro).

The holotype, allotype, and several paratypes are being deposited in the United States National Museum; paratypes are also being deposited in the following collections: Bernice P. Bishop Museum, Hawaiian Sugar Planters' Association, University of Hawaii, and the British Museum (Natural History).

The specimens were collected on the moss- and lichen-covered ground, hence the name *bryophila* (bryo—lichen, tree-moss + phila = loving). These flies are hardly discernible in the damp and shady forest floor under dense vegetation. Holding their wings out horizontally, they totter around and leap only a few inches off the ground.

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An Undescribed Crane-Fly from the Hawaiian Islands (Diptera: Tipulidae)

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The crane-fly discussed herewith was sent to me for determination by Professor D. Elmo Hardy, who found the first specimens in Manoa Valley in early January, 1952. Subsequent collecting revealed the fact that the species occurred not only on Oahu but also on Kauai, indicating that the introduction to the islands was not particularly recent. I have compared the fly with approximately 100 species of the subgenus in my collection and believe that it must have been introduced into the islands from some place in the Americas, since it is obviously allied to those species that center about *Limonia* (*Geranomyia*) *canadensis* (Westwood), having a composite range from Canada as far south as the Argentine. Despite its close relationships with certain of these flies I cannot determine it as being any of the previously described forms and must regard it as being new. The species will be further discussed and figured by Hardy in the forthcoming volume treating of the Nematocera in the "INSECTS OF HAWAII." The types have been returned to Professor Hardy. The holotype and allotype are to be deposited in the U. S. National Museum. The paratypes are being placed in the following collections: B. P. Bishop Museum, Hawaiian Sugar Planters' Association, University of Hawaii and the C. P. Alexander collection.

Limonia (Geranomyia) advena, new species

Allied to *canadensis;* mesonotal praescutum chiefly covered by three brown stripes, the posterior sclerites of the mesonotum gray pruinose; rostrum relatively long, nearly one-half the remainder of body, brownish black throughout; femora light brown with a darker subterminal ring; wings subhyaline, unpatterned except for the large pale brown stigma; Sc_1 ending nearly opposite midlength of Rs; male hypopygium with the ventral dististyle unusually small, its rostral prolongation long and narrow, the two spines elongate, placed at or near the tip, arising from very unequal basal tubercles.

Male.—Length, excluding rostrum, about 6.5-7.5 mm.; wing 7.3-8.5 mm.; rostrum about 3-3.8 mm.

Female.—Length, excluding rostrum, about 5.5-7 mm.; wing 5.5-8 mm.; rostrum about 2.5-4 mm.

Rostrum relatively long, nearly one-half the remainder of body, brownish black throughout; maxillary palpi very small. Antennae dark brown to brownish black; flagellar segments long-suboval, with truncated ends; verticils small and inconspicuous. Head above gray, paling to obscure yellow beneath; anterior vertex (male) narrow, less than the diameter of the scape.

Cervical sclerites and pronotum dark brown, the scutellum and pretergites more yellowed. Mesonotal praescutum chiefly covered by three brown stripes, the narrow interspaces more pruinose, the lateral margins narrowly pale; posterior sclerites of notum brown, more heavily pruinose, especially the postnotum. Pleura pale, heavily pruinose, least so on the ventral sternopleurite. Halteres with stem pale, knob more infuscated. Legs with all coxae and trochanters yellow; femora light brown with a darker subterminal ring; remainder of legs darker brown. Wings subhyaline, unpatterned except for

the large pale brown stigma; veins brown. Venation: Sc long, Sc_1 ending nearly opposite midlength of Rs; free tip of Sc_2 lying just proximad of R_2; cell 1st M_2 relatively narrow, a little widened outwardly, nearly as long as the distal section of vein M_3; m-cu close to the fork of M; vein 2nd A gently sinuous.

Abdominal tergites dark brown, sternites yellow; styli of hypopygium clearer yellow. Male hypopygium with the ninth tergite transverse, the posterior border emarginate; lobes conspicuous, with abundant coarse setae. Basistyle with the ventromesal lobe large. Dorsal dististyle a slender strongly curved sickle, its tip acute. Ventral dististyle unusually small, the rostral prolongation long and narrow, the usual two spines placed at or near the apex; spines elongate, from very unequal basal tubercles, the one from the longer tubercle more strongly curved. Gonapophysis with the mesal-apical lobe a pale blade that narrows to an acute point. Aedeagus long and narrow.

Holotype male, allotopotype female, Honolulu, May, 1952 (E. Dresner). Paratopotypes, 1 male, 2 females; paratypes, 3 females, Manoa Valley, Oahu, January-April, 1952 (Dresner and Hardy); 2 females, Kaimuki, Oahu, March 15-May 11, 1952 (G. Hirata, H. Sakamoto); 1 female, McKinley, Oahu, June 7, 1952 (Y. Kaneko); 2 females, Mana, Kauai, July, 1952 (Hardy).

The most nearly allied species and races include *Limonia* (*Geranomyia*) *argentinensis* Alexander, *L.* (*G.*) *austroandina* Alexander, *L.* (*G.*) *canadensis* (Westwood), *L.* (*G.*) *communis* (Osten Sacken), *L.* (*G.*) *guatemalensis* Alexander, and *L.* (*G.*) *remingtoni* Alexander. It is most like the last-named species but is well distinguished by the hypopygial characters, as well as the unusually small ventral dististyle and the conformation of the rostral spines. The subgenus *Geranomyia* is new to the Hawaiian fauna.

Observations on the Biology and Habits of Pupal Parasites of the Oriental Fruit Fly

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The campaign for the biological control of the oriental fruit fly (*Dacus dorsalis* Hendel) in the Hawaiian Islands has been outlined by Carter (1950). Some of the shipments of *Tephritidae* puparia sent to Hawaii by the parasite explorers produced chalcidoid and proctotrupoid pupal parasites. Cultures of these parasites, which included several species of *Spalangia, Dirhinus, Psilus, Pachycrepoideus,* and *Trichopria,* were propagated in the quarantine room of the Pineapple Research Institute in Honolulu. Information on the biology and habits of these parasites obtained during the course of investigations undertaken to develop better propagation methods and to determine the extent to which they might serve as secondary parasites is presented in this paper.

The large number of oriental fruit fly puparia and similar puparia parasitized by *Opius vandenboschi* Fullaway required for these studies were supplied by the Mass Production Methods Laboratory of the University of California Agricultural Experiment Station located in Honolulu.

Spalangia spp.—Three species each from southern India and northern Borneo and one each from Thailand, Formosa, Mindanao, New Caledonia, China, and Fiji were maintained in culture in the quarantine room. The only culture identified as to species was the one from New Caledonia. This contained *Spalangia philippinensis* Fullaway, which had become established on Oahu in the Hawaiian Islands after releases during a campaign for biological control of the Mediterranean fruit fly many years ago. *S. philippinensis* was also identified from material from southern India and the Philippine Islands. The *Spalangia* specimens from other countries were believed to represent distinct species, but the same insect may have been present in more than one of the cultures.

All the *Spalangia* species could easily be reared in the laboratory in large numbers. It was only necessary to supply them with fresh fruit fly puparia, a sugar cube, and a wet-wick (dental floss) water supply. After exposure to the parasites for 1 week, the puparia were put in separate holding vials. *Spalangia* parasites emerged from the exposed material over a period of 3 to 4 weeks after completing their development in the host material. It was necessary to keep each week's collection of puparia in a separate container, because by the end of the 4-week emergence period (2 months after pupation) an unidentified mite attacked them, often causing severe mortality.

[1] In cooperation with the University of Hawaii, Territorial Board of Agriculture and Forestry, Hawaiian Sugar Planters' Association, Pineapple Research Institute, and the University of California.

The reared adults ranged in length from 2 to 6 mm. Variations in length were associated with species and not with the size of the host puparium. The only exceptions were the larger species that produced smaller individuals when they were propagated on *Drosophila*.

Both sexes of all species were attracted to light, but the females, when given a choice between flying to a light or staying with either new or old puparia, always stayed with the puparia.

In the culture jars many adults were seen at all times on the wick, which supplied water. If the water supply was removed or the wick happened to dry up, mortality in the jar was very high. A period of 48 hours without water usually was fatal to the entire culture.

The parasites fed readily on the sugar cube in each jar. Honey, a good source of both food and moisture, was not used because more frequent replacement was necessary and the adults were trapped by it. The oriental fruit fly host contained the only protein provided. Male adults confined for 10 days with oriental fruit fly puparia did not cause any mortality by predation, and there was no cannibalism. After emergence, some of the parasites returned to the insides of puparia through the emergence holes, presumably to feed on the remnants of the host material.

Males and females of all species were sexually mature upon emergence, and they mated soon afterward. Copulation required from 1 to 2 minutes. Rarely was there any courtship beyond the very rapid stroking of the female head by the male antennae during actual copulation. Newly emerged females usually visited the water supply before laying eggs.

Although the female parasites roamed all over the puparia and attempted to oviposit elsewhere, they were not able to penetrate the pupal case anywhere except in the region of the anal spiracles. Prior oviposition in puparia did not seem to decrease their attractiveness, and duplicate parasitization was common.

Egg counts were made at the end of a 12-hour exposure of 7 puparia to 3 newly emerged *Spalangia*. The eggs were found in the anal cups inside the host puparia, usually not touching the abdomens of the oriental fruit fly pupae. The numbers of eggs found in 6 of these puparia were 2, 3, 5, 6, 8, and 22. The seventh puparium had only a single egg, and it was imbedded in the prothorax.

The oviposition period lasted from 2 to 10 minutes, not including the time spent futilely in attempts to insert the ovipositor elsewhere than near the anal spiracles. Sometimes 15 minutes would be devoted to these abortive efforts. The females were frequently distracted while searching for an oviposition site by the presence of another female on the same puparium, a male attempting to mate with her, or by an adjacent puparium. When ovipositing the female straddled the anal portion of the puparium, with the ovipositor pointing slightly forward and the antennae tightly pressed against the pupal case.

The eggs of *Spalangia* were all elongate-ovate, with nipple-like protuberances at their anterior ends. The nipple in some species was about 0.25 mm. long, or about half the length of the egg. When the complete life cycle was 20 days, the egg stage lasted from 72 to 96 hours. The egg

seemed to be very delicate, since not a single one was able to complete its development after it had been moved from its original position.

The larvae of all species were hymenopteriform in all instars. They fed externally on the host pupae and moved about frequently, apparently without any pattern of positional preference. Last-instar *Spalangia* larvae were distinct because of the paired abdominal tubercles on segments 1 to 8.

The length of the larval period for all species was about 10 days when the entire life cycle was 20 days. No fecal matter was eliminated by the larvae until they pupated, when the entire large fecal mass was discharged inside the peritrophic membrane. The gray larvae became pure white after the fecal discharge. The pupa was formed with its abdomen resting on top of the meconium mass.

The pupal period lasted about 7 days. This period included about 2 days for the larva to change to a recognizable exarate pupa and 2 days more before melanization began. The pupae were formed with their heads facing towards either the anal or cephalic ends of the fly puparia. The new adults partially preened themselves within the puparia before emerging, scraping off most of their pupal skins. The emergence holes, roughly circular and about 1 mm. in diameter, usually were cut through the sides of the puparia. In cutting emergence holes, the *Spalangia* showed a preference for the third segment from either end. Most of the holes were near the anal end.

In material from laboratory rearings the ratio of females to males was 1.2 to 1. In field-collected material from North Borneo this ratio was 1.4 to 1 for species No. 1, and 1 to 1 for species No. 2.

All ages of oriental fruit fly puparia proved to be suitable breeding hosts. The ability of the *Spalangia* to develop on an adult fly inside a puparium but ready to emerge indicated that the female may inject a paralytic or lethal toxin at the time of oviposition.

The period from first exposure of fruit fly puparia to *Spalangia* to the first emergence of parasite progeny ranged seasonally from 21 to 35 days in the quarantine room, where temperature conditions varied only slightly. The developmental period was longest during the winter months. The material from China failed to produce progeny during a 5 months period beginning in November. Dissections of the exposed fruit fly puparia showed that many of the parasite larvae were in diapause. The Chinese material that entered diapause had previously produced four successive generations in the laboratory, each requiring about 1 month. The Borneo species No. 1 oviposited normally when kept in the dark for 4 days.

All the *Spalangia* species were also reared in the quarantine room on the Mediterranean fruit fly (*Ceratitis capitata* (Wiedemann)) and the melon fly (*Dacus cucurbitae* Coquillett). The South India *Spalangia* was reared on a local *Drosophila* and on the house fly (*Musca domestica* L.). Another South India species, when collected from field material, was thought to be derived from *Drosophila* because of its very small size. When this *Spalangia* was placed on the oriental fruit fly it consumed only

a small portion of the body of the host material inside each puparium. A test consisting of the simultaneous exposure of all three species of fruit flies and the house fly indicated that the South India *Spalangia* has no ovipositional preferences.

The large number of eggs often deposited in a single puparium suggested that more than one individual might develop on a single host. Examinations of puparia often revealed two parasite larvae feeding on the same host, but segregation of 200 fruit fly puparia exposed to the Mindanao *Spalangia* resulted in only two instances of two parasites emerging from the same puparium. One puparium had a single emergence hole; in the other there were two holes, both at the same end.

The death of the host pupa, which occurred either very early in the feeding period of the parasite larvae or soon after oviposition, suggested that the larvae of *Spalangia* are fundamentally saprophytic rather than parasitic. When a host pupa and an unhatched parasite egg were removed from a puparium and placed in a Petri dish, a normal adult parasite developed. The handling of the fly pupae often caused their death; yet the development of *Spalangia* was not affected. Some pupal parasites emerged from foreign shipments that arrived in such poor condition that they failed to produce flies.

Shipments of oriental fruit fly and *Carpomyia vesuviana* Costa puparia, reared from *Zizyphus jujuba* Lamarck in Thailand, produced *Spalangia*. With the disappearance of the oriental fruit fly from the shipments, no more of these parasites emerged. When field-collected *C. vesuviana* puparia were exposed to the Thailand parasites in the quarantine room, the first fruit fly did not emerge until 15 days after the initial exposure, and no parasites emerged nor could they be found in dissected samples. This was the only instance observed in the quarantine room of apparent immunity by a tephritid to *Spalangia* parasitism.

Seven cultures, each consisting of material from a different geographical area, were tested to determine the net effect of parasitization by *Spalangia* on parasitized oriental fruit fly puparia. In each test fruit fly puparia that had been exposed to *O. vandenboschi* were divided into two lots. One lot was held in one emergence jar, while the other lot was placed in another jar and was exposed for 4 to 8 days to large numbers of the pupal parasites. The total emergence of fruit flies and *Opius* from both groups of puparia was observed, and the expected numbers of flies and opiines in the *Spalangia*-exposed group were estimated from the number produced in the check group. The number of parasites that ultimately emerged from both groups was also determined. The results are presented in table 1, and the data for all the individual tests are plotted in figure 1.

The evidence was conclusive that none of the *Spalangia* species were preferential secondary parasites. Most of their development was in nonparasitized puparia and in most tests the number of parasites that emerged was much greater than the number of opiines that had been destroyed by the pupal parasites. When the percentages of flies killed were plotted against the percentages of *Opius* killed (fig. 1), all results fell within a zone which may be referred to as the area of greater fly mortality.

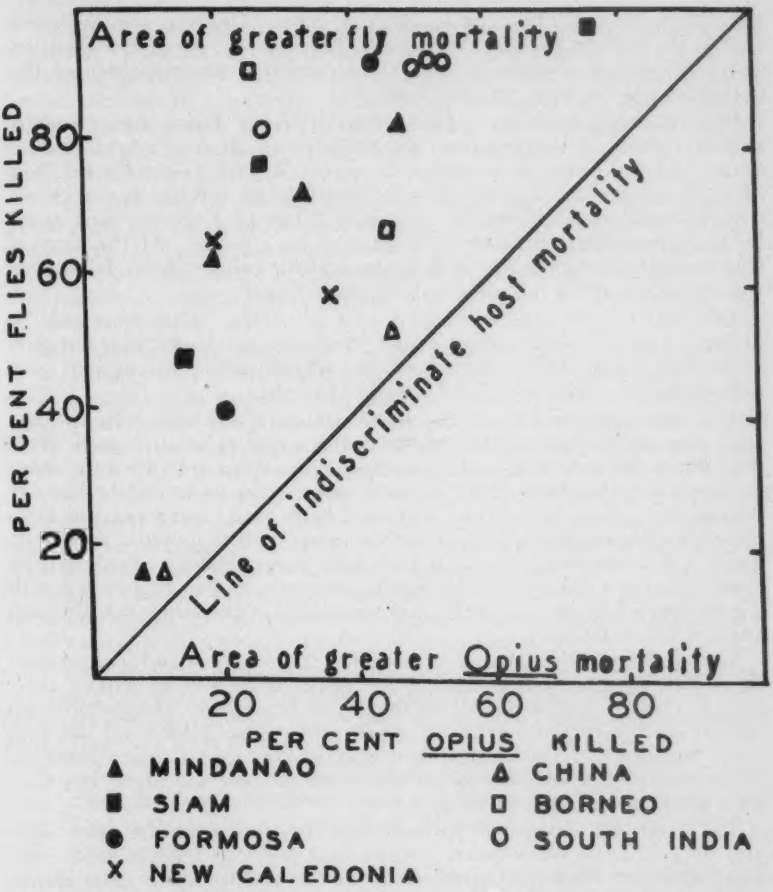

Figure 1. Individual tests of host mortality by seven *Spalangia* cultures. Hosts are *Dacus dorsalis* and *Opius vandenboschi*.

Some of the tests involved long exposures of the puparia to large numbers of parasites, and such exposures often resulted in very high percentages of parasitization. When parasitization was higher than 80 per cent, it was mostly at the expense of the *Opius*. The ratio of emerging *Spalangia* parasites to the numbers of *Opius* killed averaged about 2 to 1. The end product of the parasitization by *Spalangia* in these tests was the destruction of 64 per cent of the flies, but only 32 per cent of the opiines.

The much higher parasitization of flies at the lower range may have been due to ovipositional preferences of the female *Spalangia* or to the resistance of the *Opius* larva. Observations indicated that the parasites

were probably indiscriminate in selecting hosts. The tests also indicated that at the highest parasitization levels the effect of repeated oviposition into a puparium containing the *Opius* overcame the resistance of the opiine host, if the latter was involved.

Dirhinus spp.—*Dirhinus giffardii* Silvestri from Africa and Australia and *D. luzonensis* Rohwer from the Philippines are now established on Oahu, and the former is occasionally recovered from field-collected fruit flies. *D. luzonensis,* apparently a self-introduced species, has been recovered mostly from house fly puparia. All *Dirhinus* observations noted here, unless otherwise designated, refer to *D. giffardii.* At the time of this study *D. luzonensis* was in diapause and the culture in the laboratory was not adequate for tests or extensive observations.

The adults of *D. giffardii* were 3 to 4 mm. long. They were able to fly well, and were resistant to rough handling and inadequate supplies of food or water. When disturbed they feigned death for periods of 2 minutes or less. Both sexes were attracted to light.

The laboratory rearing of this insect was very successful, the cultures requiring only fresh puparia, water, and a sugar cube once each week. The adults fed more extensively on a sugar cube than did any of the other pupal parasites studied. After their exposure to the parasites, the fruit fly pupae were placed in separate vials and held until emergence was complete. Since male adults in a jar with oriental fruit fly puparia caused no mortality, it was concluded that they were not predatory. Predation by females was not observed. The rearing chamber had to be covered with a wire screen, because the adult parasites readily worked their way through any type of cloth cover.

The adults mated immediately after they had emerged and had preened themselves to remove remnants of the pupal skins and to smooth their wings. The females oviposited on the day of emergence. Oviposition was usually on the center portion of a host puparium. Nearly all the eggs were deposited at the ventral junction of the thorax and abdomen. Occasionally eggs were found on the head or near the anus, but they were always in a ventral position.

The parasites oviposited without any discrimination between light and dark puparia or between normal and previously parasitized ones. Egg counts in 18 host puparia exposed to this parasite gave results as follows: 7 with no eggs, 7 with 1, 2 with 2, and 2 with 5.

The egg of *D. giffardii* is white, nearly hyaline, about 0.6 mm. long, and crescent-shaped. It has a slight dorsal arch and a greater diameter at the cephalic than at the caudal end. It is not so delicate as the eggs of *Spalangia,* and will hatch even after it has been picked up and moved. In these studies hatching occurred within 36 to 48 hours when the total developmental period of the parasite was 19 days.

The newly hatched larva is of the caudate type, and the mature larva is hymenopteriform. The larva feeds externally on its host. It migrates a great deal within the fruit fly puparium, and on dissection can be found on any portion of the host. The period from oviposition to pupation was 10 to 12 days when the period from oviposition to the adult stage was 19 or 20 days. The males emerged about 24 hours before the females.

The larvae eliminated their accumulated wastes only at the time of pupation. Pupation occurred with the abdomen resting on top of the meconium pile, and with the head end always pointed toward the cephalic end of the fruit fly puparium. When ready to emerge, the adult parasite applied pressure with the horns on its head to the dorso-cephalic portion of the pupal case and with its forelegs to the ventro-cephalic portion until one of the sections gave way.

D. giffardii was successful in parasitizing all ages of oriental fruit fly puparia except those older than 8 days. Nine and 10-day-old puparia exposed to this parasite produced only flies. The normal development of the older host material, despite exposure to *Dirhinus*, is evidence that this parasite, unlike *Spalangia*, does not paralyze its host during the oviposition process.

Four mated females that lived 5 weeks produced 49 to 53 progeny each, or an average of 51. However, since they were not provided with unlimited numbers of puparia, this average is believed to be considerably below their maximum potential. Peak oviposition occurred within the first 2 weeks, with a very sharp decline thereafter. The sex ratio ranged from 1.8 to 6.1 females per male, with an average of about 3 to 1. The tests resulted in an over-all production of 153 females and 53 males.

The period from oviposition of *D. giffardii* to the first adult progeny ranged seasonally from 19 to 38 days for material from India, and the developmental period of *D. luzonensis* ranged from 20 to 123 days, with the longest periods in both species occurring in the winter months. The diapause stage of the latter was the full-grown larva. Material from India failed to produce *Dirhinus* from December to March.

Parasite progeny were obtained when oriental fruit fly puparia were exposed to *D. giffardii* in the dark. This parasite was also reared on the melon fly and the Mediterranean fruit fly, but the results of host studies with *Drosophila* were all negative.

The emergence of a few very small parasites suggested that more than one individual sometimes developed in a single host puparium. Dissections occasionally revealed more than one living first-instar larva inside a single puparium.

Oriental fruit fly pupae containing *Dirhinus* eggs were removed from their pupal cases and placed in a Petri dish. The parasite eggs hatched and developed to maturity in this exposed condition, even when the host was mangled during the dissection process. This indicated that the *Dirhinus* larva is a saprophyte, rather than a true parasite. The normal host was always dead and in a state of decay long before larval feeding was completed.

Two cultures of *Dirhinus giffardii* (golden pile) from northern and southern India were tested for secondary parasitism, by the same method described for *Spalangia*. The results are summarized in table 1. Most of the data from the various tests are distributed along the line of indiscriminate host mortality in figure 2. This distribution indicates that *D. giffardii* is not host selective, but attacks and develops equally well on both *Opius vandenboschi* and the oriental fruit fly. The results of

the January 30 and February 8 tests suggest that under some conditions there may be a slight preference for the dipterous host.

Psilus spp.—Both sexes were attracted to light. The adults were very sensitive to the lack of water and usually died within 24 hours unless a supply was available. There was a tendency for the adults to feign death when disturbed, but in this they were not so adept or so persistent as *Dirhinus*.

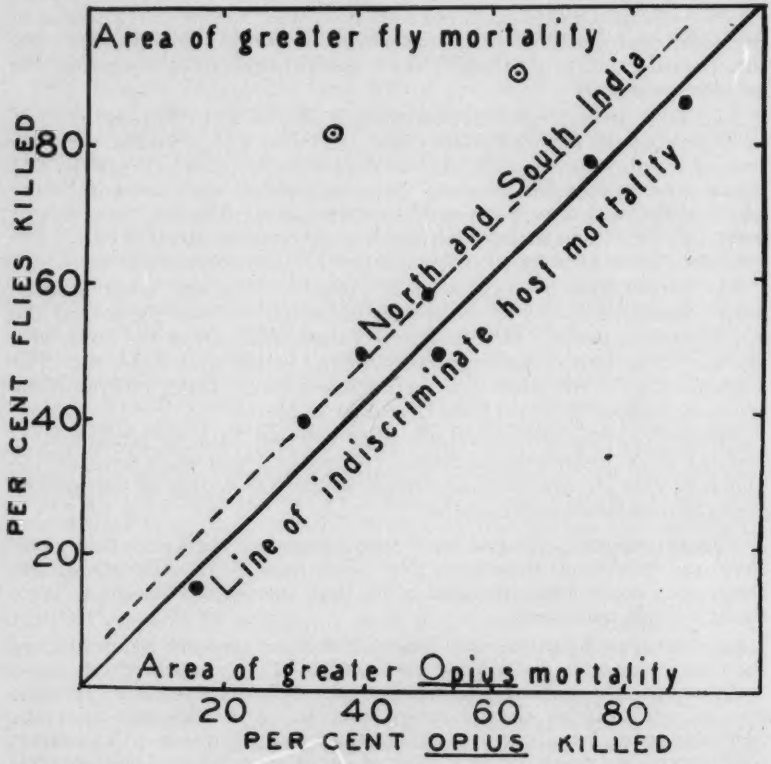

Figure 2. Individual tests of host mortality by *Dirhinus giffardii* from North and South India. Hosts are *Dacus dorsalis* and *Opius vandenboschi*.

The laboratory culture of these insects was also successful, the only requirements being a supply of host puparia, a sugar cube, and water. With these supplies the adults lived more than 3 weeks. The parasites readily worked their way through a thin cloth; therefore it was necessary to use 30-mesh wire screening to keep them in the culture jar.

There was no evidence of cannibalism by the adults. Males confined with oriental fruit fly puparia for 10 days did not cause any mortality.

Upon emerging the adults consumed water, then mated and oviposited in rapid succession. Mating required ½ to 2 minutes. During copulation the antennae of the male stroked those of the female. A second male was observed to mate with a mated female.

Oviposition required from 2½ to 4 minutes, the female usually standing over the cephalic end of the oriental fruit fly puparium. The ovipositor was inserted through the side of the puparium and the egg was deposited within the host body. Three females were once observed ovipositing on the same puparium at the same time.

The eggs hatched in about 4 days when the complete life cycle lasted 23 days. The larva fed internally and never penetrated the pupal skin of the host fly. Larval development was completed in about 9 days. The first elimination of fecal material was at the time of pupation, when a chain of meconium globules was released into the cavity made by the pupal sack, which was all that remained of the host. Usually a *Psilus*-parasitized puparium could be recognized under a microscope by the globules, which showed through the thin puparium wall.

Psilus pupae were always formed with their heads at the cephalic ends of the fruit fly puparia. The adult parasites emerged at the cephalic ends of the puparia, usually breaking out through the dorso-cephalic portions. None of the puparial wall was chewed out during the emergence process.

Tests with oriental fruit fly pupae indicated that *Psilus* is able to oviposit and develop in all ages of puparia, from those newly formed to those 10 days old. Progeny were not produced from eggs deposited in 10-day old puparia.

Psilus was also reared on the melon fly and the Mediterranean fruit fly, but tests with two species of *Drosophila* were negative.

The period from the exposure of fruit fly puparia to *Psilus* until first emergence of progeny usually ranged from 23 to 41 days, the longest periods being required in the winter months. Females emerged about 36 hours after the first males. Full-grown larvae of *Psilus* from northern India went into diapause twice. When this occurred, the adult parasites did not emerge until more than 60 days after oviposition.

Three cultures of *Psilus* derived from material collected in northern and southern India and Mindanao were tested for secondary parasitization tendencies. The method used was exactly the same as that described for *Spalangia* and *Dirhinus*. The data are summarized in table 1. The results of the tests with the Mindanao *Psilus* (fig. 3) indicate that hosts were selected at random. The tests with the two India *Psilus* indicated some preference for the oriental fruit fly host, but they did not include as many puparia, nor were they as well replicated as the Mindanao tests. There seemed to be no morphological differences between the individuals of these three cultures. Virgin females from northern India and from Mindanao readily mated with males from southern India and produced fertile females. These in turn produced a female generation when backcrossed with males of the parent species.

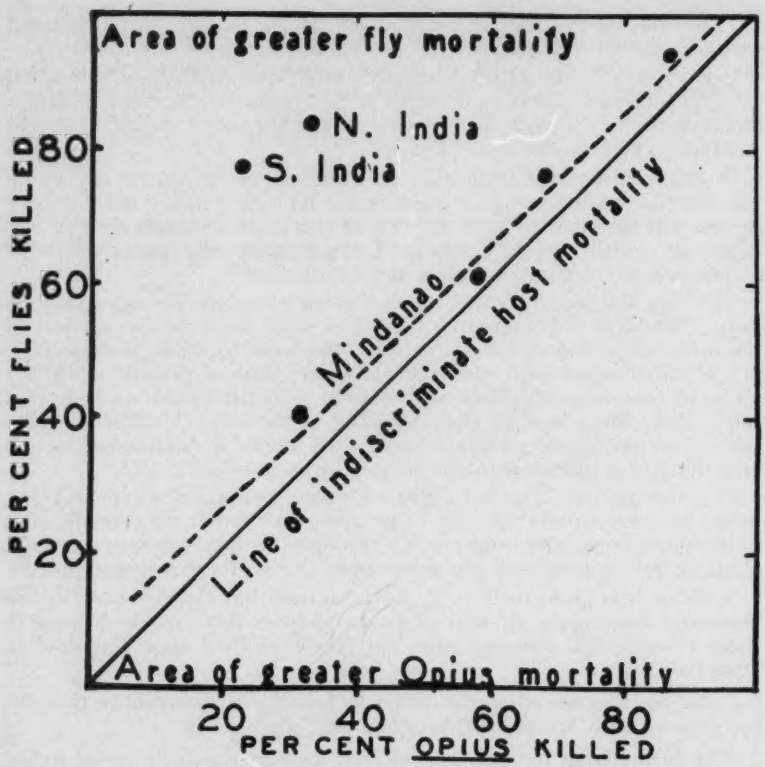

Figure 3. Individual tests of host mortality by *Psilus* from Mindanao, southern India, and northern India. Hosts are *Dacus dorsalis* and *Opius vandenboschi*.

The only indication of biological differences between the three cultures was the diapause into which the larvae of the northern India *Psilus* entered in the quarantine room.

Pachycrepoideus dubius Ashmead—This small pteromalid was reared from pupal material from nearly all countries visited by oriental fruit fly parasite explorers. It was bred in the laboratory on both the oriental fruit fly and *Drosophila*. Those reared on one host were able to produce progeny on the other. During March the period from exposure of pupae to the first emergence of progeny was 24 days. There was no difference in the developmental periods of the males and the females.

Trichopria sp.—This small diapriid from India could not be reared on fruit fly puparia, although it readily completed its life cycle on *Drosophila*. With the latter as its host, it completed development in 19 days during March. The first female emerged 3 days after the first male.

Summary—Exposures of nonparasitized oriental fruit fly puparia and of puparia parasitized by *Opius vandenboschi* failed to reveal any secondary parasitization tendency on the part of *Spalangia* spp. There was a greater mortality of the oriental fruit fly host than of *O. vandenboschi* at all parasitization levels below 80 per cent.

Oviposition by *Spalangia* spp. was in the anal ends of the host puparia and often more than one egg was deposited in a single puparium. All the *Spalangia* species tested developed as external parasites on the host pupae within the puparia. The length of the egg stage ranged from 72 to 96 hours, the larval period averaged about 10 days, and the pupal periods about 7 days. Adults emerged through circular holes chewed out near the ends of the puparia. Mating and oviposition occurred soon after emergence. The developmental periods ranged seasonally from 20 to 40 days. One of the species entered into diapause.

Spalangia species were able to develop on all developmental stages of the oriental fruit fly within puparia from newly formed pupae to flies about ready to emerge. Development was equally good on puparia of the oriental fruit fly, the Mediterranean fruit fly, the house fly, and *Drosophila*. *Spalangia* failed to develop on puparia of *Carpomyia vesuviana*.

Dirhinus giffardii caused about equal mortality of oriental fruit fly puparia and of puparia parasitized by *Opius vandenboschi*. *D. giffardii* oviposited in the centro-ventral portion of the host puparium. The eggs hatched in 36 to 48 hours. The larvae fed externally on the host and pupated 10 to 11 days after oviposition. The adult parasites emerged 19 days after oviposition. The life cycle was longest during the winter months. Even with insufficient host material, single females produced 49 to 53 progeny, with a range from 1.8 to 6.1 females per male. *Dirhinus* was not able to develop in oriental fruit fly puparia more than 9 days old.

Psilus sp. from Mindanao likewise caused no greater mortality of the oriental fruit fly than of *Opius*. Oviposition was through the sides of the puparia, the eggs being placed within the host. The parasite larva and pupa developed within the pupal sack of the host. The eggs hatched in 4 days, the larvae pupated 9 days later, and the adults emerged about 23 days after oviposition. *Psilus* developed in all ages of oriental fruit fly puparia, from those newly formed to those 9 days old. The total developmental period ranged from 23 days in summer to 60 days in winter.

LITERATURE CITED

Carter, Walter, 1950. Oriental Fruit Fly: Progress in Research. Jour. Econ. Ent. 43(5): 677-683.

Table 1. Secondary parasitization tests.

Source	Oriental fruit flies				Opius vandenboschi			Parasites emerged	
	Number of pupae	Number that emerged	Number expected	Per cent killed	Number that emerged	Number expected	Per cent killed	Number	Ratio to Opius killed
		Spalangia							
South India	320	28	166	83	45	82	45	125	3.4
Mindanao	1,010	214	487	56	216	300	28	192	2.3
Siam	1,045	130	507	75	225	326	43	284	2.8
New Caledonia	459	89	235	62	103	143	28	79	2.0
Formosa	1,012	123	487	75	191	313	39	251	2.0
China	454	168	234	28	108	148	27	10	.25
Borneo	79	17	48	64	10	23	56	12	.92
Total	4,379	769	2,164	64	898	1,335	32	953	2.2
		Dirhinus giffardii Silvestri							
South India	1,037	146	580	75	139	381	63	454	1.9
North India	1,264	273	598	54	242	389	38	358	2.4
Total	2,301	419	1,178	65	381	770	51	812	2.1
		Psilus							
North India	86	10	52	81	17	25	32	3	.38
South India	200	28	120	77	38	48	21	71	7.1
Mindanao	1,222	196	570	66	165	373	56	401	1.9
Total	1,508	234	742	70	220	446	51	475	2.1

The Genus Xyletobius on Oahu, with Descriptions of New Species (Coleoptera: Anobiidae)

By E. J. FORD, JR.

The first taxonomic work on the endemic Hawaiian genus *Xyletobius* was contributed by David S. Sharp (Trans. Ent. Soc. London, 1881: 520-522), when he described three species as the basis of the genus, i.e., *marmoratus, oculatus,* and *nigrinis. X. marmoratus* is hereby designated as the genotype. In 1885 (Trans. Dublin Soc., p. 158), Dr. Sharp and Rev. Blackburn described four more species. The third and largest account was submitted by R. C. L. Perkins in 1910 (Fauna Hawaiiensis 3, pp. 585-613), in which he described 45 new species of *Xyletobius.* The last addition to this genus was a single species by Dr. Perkins in 1920 ("PROCEEDINGS" 4:505). Thus in Hawaii there are 53 species, 28 of which have been recorded from Oahu.

Some of the characters used in the following key were taken from Dr. Perkins' grouping of the species.

Key to the Oahu Species of Xyletobius

1. Pronotum tuberculate ..... 2.
   Pronotum not tuberculate ..... 3.
2. Longer than 5 mm.; elytra covered with pale brown pubescence except the sides which are dark brown ..... **walsinghamii** Perkins
   Shorter than 5 mm.; mottled with pale and dark brown pubescence ..... **sylvestrii** Perkins
3. Pronotal outline not laterally convex; nearly a straight line ..... 4.
   Pronotal outline laterally convex ..... 5.
4. Pubescence scanty, dorsal sculpture easily seen; length 3 mm ..... **grimshawi** Perkins
   Pubescence dense, dorsal sculpture obscured; length 4-8 mm ..... **timberlakei** Perkins
5. Elytra with yellow or red spots ..... 6.
   Elytra without yellow or red spots ..... 13.
6. Antennal segments 7-10 at least twice as long as wide and conspicuously longer than the preceding segments ..... 7.
   Antennal segments 7-10 not twice as long as wide and usually not conspicuously longer than the preceding segments ..... 10.
   (Note: this character more pronounced in the male.)
7. Legs black or nearly so ..... 8.
   Legs yellow or red ..... 9.
8. Yellow pubescence only on the elytral spots ..... **beddardi** Perkins
   Yellow pubescence pale and generally distributed on the elytra ..... **ashmeadi** Perkins
9. Elytra with dark golden pubescence throughout; length 2.5 mm ..... **forelli** Perkins
   Elytra with varicolored pubescence ..... **blackburni** Perkins
10. Pronotum with two yellow spots ..... **sharpi** Perkins
    Pronotum without yellow spots ..... 11.
11. Pronotum with a bare medial line ..... **roridus** Perkins
    Pronotum without a bare medial line ..... 12.

12. Pubescence long and woolly ..... **fraternus** Perkins
Pubescence short and straight ..... **simoni** Perkins
13. Without tangential or varicolored pubescence ..... 14.
With tangential or varicolored pubescence or both ..... 16.
14. Robust, black species ..... **aleuritis** Perkins
Elongate, brown species ..... 15.
15. Elytral striae 2 and 5 confluent ..... **gossypii** n.sp.
Elytral striae 4 and 5 confluent ..... **chenopodii** n.sp.
16. Pronotum feebly explanate at the sides; small species ..... 17.
Pronotum conspicuously explanate at the sides; medium size species ..... 21.
17. Pronotum with the anterior margin laterally raised or prominent ..... 18.
Pronotum with the anterior margin not raised, simply rounded ..... 19.
18. Pubescence bright golden on the pronotum in contrast to the copper colored elytra ..... **sykesii** Perkins
Pubescence entirely golden on the dorsum ..... **chryseis** Perkins
19. Black species with long antennae ..... **suboculatus** Perkins
Not black; antennae short ..... 20.
20. Elytral pubescence arranged to give the impression of alternate light and dark longitudinal lines ..... **lineatus** Sharp
Elytral pubescence not arranged to form longitudinal lines; bright golden, robust species ..... **lasiodes** Perkins
21. Pronotum raised and shining on the anterior margin; elytra without transverse bands ..... **proteus** Perkins
Pronotum not raised and shining on the anterior margin; elytra with transverse bands ..... 22.
22. Pubescence dark fuscous, the transverse bands golden ..... **marmoratus** Sharp
Pubescence not fuscous ..... 23.
23. Elytra with brassy pubescence; the dark areas vary in size and contour when viewing the insect at different angles ..... **bidensicola** n.sp.
Elytra with buff pubescence, sometimes reflecting pink; the transverse bands brown ..... **euphorbiae** Perkins

The following species were recorded from Oahu by Dr. Perkins, but are not included in the key for the reasons indicated.

euceras Perkins: Dr. Perkins' discussion of this species leaves some doubt regarding Oahu as its habitat. I have not seen a specimen. (F.H. 3:594.)

euops Perkins: I have not seen this species. (F.H. 3:601.)

cyphus Perkins: This species was described from a single mutilated specimen according to Dr. Perkins. I have not seen a specimen. (F.H. 3:603.)

mundus Perkins: Described from a single specimen. Dr. Perkins considers it possibly a variety of *sykesii*. I have been unable to locate another example. (F.H. 3:608.)

Xyletobius gossypii, new species

Male: Elongate, medium sized, integument brown throughout, covered with an aureous pubescence; dorsum granulose. *Antenna:* Slender, thinly pubescent; third to eleventh segments becoming longer and less serrate from base to apex, except for the ninth and tenth segments which are equal in length; terminal segment filiform, slightly longer than tenth. Several long setae on each segment contrasting with the shorter uniform tomentum. *Head:* Including the eyes, practically as wide as the distance between the frontal angles of the pronotum; granulate, these granules mostly about as wide as the distance between them; densely pubescent; setae longer near the mouthparts; distance between the eyes in front about as wide as the combined width of the eyes. Maxillary palpus slightly emarginate; labial palpus truncate at the apex of the terminal segment; mandibles prominent with a tooth on the inner side just before the acute apex, glab-

rous and piceous apically, unevenly punctate in the basal depression which contains seven or eight long setae; eyes large, sparsely setose. *Pronotum:* From above but little wider than the base of the elytra; unevenly rounded, transverse; front angles 90°, slightly curved inward; hind angles evenly rounded, obtuse; anterior and lateral margins carinate, shining; pubescence arranged to give the impression of deep basal depressions, these depressions actually shallow. *Elytra:* Less granulate than the pronotum; striations deep, narrow, feebly punctured; interstices not convex; third and fourth striae end without joining five-sixths the distance from base to apex; second and fifth striae terminate and unite just behind third and fourth; sixth and seventh striae unite and terminate farther from the apex than the ends of the third and fourth; ninth and tenth striae join near the apex; none of the striae reach the apical margin; humeri obviously but feebly raised. *Abdomen:* Visible sternites truncate at the hind margins, except the first which is convex posteriorly at the middle; distance between the middle and hind coxae less than the length of the first three visible sternites combined. *Legs:* Slender; femora slightly swollen; first tarsal segment of middle and hind legs longer than the three following segments combined, and twice as long as the second segment; tibiae small. Length: 4.2 mm., breadth: 2.0 mm.

Allotype: Abdomen slightly swollen; smaller eyes; two small but obvious tubercles near the posterior margin of the apical sternite. Length: 4.3 mm., breadth: 2.0 mm.

Paratypes: 6 males, length: 3.8-5.1 mm., and 5 females, length: 4.1-5.9 mm.

Type locality: Oahu, Waianae-Nanakuli coast; altitude 25 ft.

Holotype male and allotype in the Bernice P. Bishop Museum. Two paratypes in the collection of the Hawaiian Sugar Planters' Association Experiment Station, and one paratype in the British Museum (Natural History). The remaining paratypes in the collection of the author.

A series of 12 specimens were collected by the author in dead stems of an endemic cotton plant (*Gossypium tomentosum* Nuttall) between December, 1951, and November, 1952, and a single specimen from *Sida* collected by O. H. Swezey, Kaimuki, Oahu, 1923.

X. gossypii bears a strong superficial resemblance to *chenopodii* new species, its closest ally, but the pronotum is less explanate, the abdomen less elongate, and the eyes of the male smaller than those of *chenopodii*. *X. gossypii* is also allied to *aleuritis* Perkins. In Dr. Perkins' key to the species (F.H. 3, p. 585) *aleuritis* is the only species omitted, as he doubted that it really belonged to the genus. *X. aleuritis* is a robust, black species readily distinguished from *gossypii*.

X. gossypii must be considered a rare insect, although it may have been quite common prior to the depletion of the host plant and the introduction of the predaceous ant *Pheidole megacephala* (F.). Even so, where the native cotton occurs in large stands, dead stems in a suitable condition are not plentiful.

Xyletobius chenopodii, new species

Male: Extremely elongate, medium sized, uniformly covered with an aureous pubescence; dorsum granulose; integument fusco-rufous throughout. *Antenna:* Long and slender; segments six to eleven nearly equal in length; the fourth segment two-thirds as long as the sixth; moderately serrate, more so basally. *Head:* Distinctly granulose; granules evenly distributed, as wide as the distance between them; distance between the eyes distinctly less than the combined width of the eyes; inner mandibular tooth little shorter than the outer apical tooth; posterior portion of mandible shallowly excavated; maxillary and labial palpi testaceous, emarginate at the apices of the terminal segments; terminal segment of the maxillary palpus obtuse on the outer angle, and one-third again as long as the second segment. *Pronotum:* Moderately transverse; front angles feebly excised; slightly wider than the base of the elytra; anterior margin strongly raised, shining, dark fuscous; front angles invisible dorsally, feebly rounded, not termi-

nating in a sharp point, slightly obtuse. *Prosternum:* Tomentum fine, sparse, pale; sclerotization accentuated by sutures darker than the ground color. *Elytra:* Extremely elongate; striae fine but deeply impressed; first stria extends 0.6 mm. past the apex of the scutellum; fourth and fifth striae unite and terminate about 0.8 mm. from the apex of the elytra; seventh and eighth striae confluent, terminating 1.0 mm. from the apex of the elytra. *Abdomen:* Sparsely granulate; combined length of the first and second visible sternites equal to the distance between the middle and hind coxae; hind sternite, at the middle, twice as long as the fourth visible sternite. *Legs:* Long, slender; middle and hind femora convex outwardly, concave inwardly; first segment of hind tarsus as long as the second, third, and fourth combined; second segment as long as the third, fourth, and fifth combined. Length: 4.2 mm., breadth: 2.0 mm.

Allotype: Distance between the eyes slightly greater than the combined width of the eyes; antenna similar to the holotype but shorter; prominent tubercles near the hind margin of the apical sternite. Length: 6.0 mm.; breadth: 2.7 mm.

Type locality: Oahu, Puu Palikea, Waianae Mountains, 1800 feet.

Holotype male and allotype deposited in the Bernice P. Bishop Museum.

The author, while collecting living stems of *Chenopodium oahuense* for breeding an endemic cerambycid, noticed the recent exit holes in some dead, dry stems. Two sections of the latter material about 1 foot long and 2 inches in diameter were also collected. The two specimens issued on April 18 and 24, 1953.

This species is very similar to *X. gossypii,* but it is more elongate, the pronotum is differently formed, and the eyes are wider than *gossypii. X. chenopodii* is extremely rare, as the host plant is common only in a few large stands, and suitable material for *chenopodii* is rapidly being destroyed by climatic conditions and other insects, to say nothing of heavy parasitism which seems to affect most of the species of *Xyletobius.*

Xyletobius bidensicola, new species

Male: Robust, with aenescent, tangential tomentum. *Antenna:* Moderately long; the two basal segments testaceous; remaining segments piceous; fourth segment nearly as broad as long; ninth and tenth segments equal in length; terminal segment twice as long as the fifth; one or two long setae on the inner angle of the first, second, and third segments. *Head:* Dark fuscous, with large granules partly obscured by coarse tomentum; distance between the eyes three and one-half times as wide as an eye; eyes of moderate size, without setae; maxillary and labial palpi testaceous; terminal segment of maxillary palpi feebly emarginate, the outer angle slightly acute, but not protruding; mandibular teeth glabrous and piceous, the inner tooth slightly shorter than the outer. *Thorax:* Light fuscous, feebly bituberculate, finely punctate on the center of the disc, punctuations obscured laterally by large granules; anterior margin hardly raised; moderately explanate laterally; posterior margin partly hidden by overlapping humeri when seen dorsally; the front angles slightly acute; beneath covered with sparse, uniform, cinereous tomentum and large granules. *Elytra:* Dark fuscous; striae sinuate, deep, impunctate; fourth and fifth striae confluent, shorter than all the others except the first which extends but little past the scutellum; aeneous tomentum may reflect purplish or pink; tangential arrangement producing spots of various magnitudes and contours, this depending upon the position of the insect and the light reflected therefrom. *Abdomen:* Piceous, swollen, granulate; tomentum pale yellow, uniform, less dense than on the dorsum; hindmost visible sternite as long as the combined length of the third and fourth visible sternites at the middle. *Legs:* Yellow; finely, sparsely tomentose; first tarsal segment of hind leg as long as the remaining segments combined. Length: 3.5 mm.; breadth: 1.8 mm.

Allotype: A horizontal, linear depression near the posterior margin of the apical sternite; antennae slightly shorter; otherwise identical to the holotype. Length: 3.8 mm.; breadth: 1.9 mm.

Paratypes: 14 paratypes measuring 3-4 mm.

Type locality: Oahu, leeward side of Mt. Kaala, Waianae Mountains, 2800 feet.

Holotype male and allotype in the Bernice P. Bishop Museum, 2 paratypes in the British Museum (Natural History), and 12 paratypes in the collection of the author.

A series of 16 specimens was bred from a native *Bidens* collected by the author on the leeward side of Mt. Kaala in April, 1952, and a single specimen from the same plant several miles south of Mt. Kaala on the windward side of the Waianae Mountains.

X. bidensicola may be placed in group (4a) of Dr. Perkins' key, or grouping, of the species (F.H. 3, p. 586). This species is similar to *X. euphorbiae* Perkins, but not easily confused with it. Although *X. euphorbiae* is similar in size and general appearance, a closer examination will reveal a less transverse pronotum, shorter antennae, the tomentum consisting of an admixture of light fuscous and cinereous with pinkish reflections. Furthermore, the elytral striae are deeper, more sinuate, the seventh and eighth striae confluent apically. *X. cyphus* Perkins probably is similar also. This species was described from a single mutilated example (F.H. 3, p. 606). According to Dr. Perkins' description, *cyphus* differs to a greater extent from *bidensicola* than from *euphorbiae*.

Host Plants of the Oahu Species of Xyletobius

On Oahu *Xyletobius* is found most numerous in the dry forest areas of the Waianae and Koolau Mountains. Since suitable host material for this genus must be dry, or nearly so, and free of fungi, it would seem that the amount of rainfall is an important factor controlling the population of the species. As in other large genera of endemic Hawaiian Coleoptera such as *Plagithmysus* and *Proterhinus*, the species of *Xyletobius* may be host specific, breed on a group of related plants, or inhabit a number of unrelated plants. The list below includes all collections of *Xyletobius* on Oahu with host records that indicated the species had been bred from the plants cited by the collector. Single species taken from a plant cannot establish without doubt the host of the species, as these insects, being nocturnal, may be taken during the daytime concealed on a variety of plants. However, a series of several specimens taken from a single host species, or single species taken repeatedly from a plant species, indicate with little doubt the host of the species concerned. The host plants of only 14 of the Oahu species are known.

walsinghamii Perkins

Oahu, 1896, guava, Perkins; Mt. Tantalus, November, 1918, *Eucalyptus*, O. H. Swezey; Mt. Tantalus, September, 1919, *Platydesma*, J. C. Bridwell; Haleauau Valley, May, 1926, *Pipturus*, O. H. Swezey; Haleauau Valley, December, 1928, *Broussaisia*, O. H. Swezey; Mt. Kaala, April, 1938, *Pipturus*, E. C. Zimmerman; Pali, December, 1952, *Urera sandwicenseum*, E. J. Ford; Haleauau Valley, March, 1953, *Pipturus*, E. J. Ford.

proteus Perkins

Mt. Kaala, March, 1938, *Gouldia*, E. C. Zimmerman.

marmoratus Sharp

Waianae Mountains, March, 1953, *Sut'on'a*, E. J. Ford.

ashmeadi Perkins
Haleauau Valley, April, 1935, *Antidesma,* O. H. Swezey; Makua, January, 1938, *Coprosma,* E. C. Zimmerman; Mt. Kaala, April, 1938, *Smilax,* E. C. Zimmerman.

beddardi Perkins
Mt. Kaala, April, 1938, *Gouldia,* E. C. Zimmerman.

forelli Perkins
Waianae Mountains, December, 1952, *Euphorbia hillebrandtii,* E. J. Ford.

sharpi Perkins
Mt. Kaala, April, 1952, *Pelea clusiaefolia,* E. J. Ford.

roridus Perkins
Waianae Mountains, April, 1952, *Euphorbia hillebrandtii,* E. J. Ford; Haleauau Valley, February, 1953, *Euphorbia hillebrandtii,* E. J. Ford.

sykesii Perkins
Palikea, February, 1935, *Xanthoxylum,* O. H. Swezey; Kaluanui, February, 1931, *Xanthoxylum,* O. H. Swezey.

timberlakei Perkins
Marsh Trail, December, 1933, *Straussia mariniana,* O. H. Swezey; Waimano Trail, March, 1953, *Straussia mariniana,* E. J. Ford.

aleuritis Perkins
Waianae Mountains, 1892, *Aleurites moluccana,* R. C. L. Perkins; Makaleha Valley, February, 1931, *Aleuritis moluccana,* O. H. Swezey; Mt. Kaala, October, 1944, *Pipturus,* O. H. Swezey; Makaha Valley, September, 1951, *Aleurites moluccana,* E. J. Ford; Puu Kawiwi, July, 1953, *Bidens,* E. J. Ford.

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The Longicorn Genus Thranius (Coleoptera: Cerambycidae)

By J. LINSLEY GRESSITT

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The genus *Thranius* constitutes most, or all, of the tribe Thraniini of the subfamily Cerambycinae. This genus is distributed across much of the Oriental Region, from Ceylon and India to South China, Formosa and Indonesia, and also to Japan, New Guinea and the Solomon Islands. Its distribution thus represents approximately the maximum direct spread of elements of the Oriental Region, except that it has not been found in the Ryukyu Islands or on certain islands of Indonesia or the Philippines. In the case of the Ryukyus its absence is probably the result of late Tertiary partial submersion of the islands and extinction if a representative of the group had migrated across the earlier connection with the South China mainland through Taiwan. In the case of certain islands of Indonesia and the Philippines it is probably a matter of insufficient collecting.

Thranius is characterized, in part, by the head being vertical in front, and thus resembling members of the subfamily Lamiinae. The pronotum is often granulose and swollen above and the elytra are very long and often narrowed in part. Nothing is known regarding the habits of this small group, which is somewhat related to the tribe Clytini and also to the Molorchini.

The genus *Lautitia* Matsushita, with a single species in Taiwan, was placed by its author in the Thraniini, but is apparently a synonym of *Mausaridaeus* Pic, placed in the Compsocerini.

Thranius contains 23 species to date, all of which are keyed and listed below, including five new species.

Genus Thranius Pascoe

Thranius Pascoe, 1859, Trans. Ent. Soc. Lond. (2) 5: 22 (type: *T. gibbosus* Pascoe); Gahan, 1906, Fauna Brit. India Col. 1: 236; Matsushita, 1933, Jl. Fac. Agric. Hokkaido Univ. 34: 224; Gressitt, 1951, Longicornia 2: 182.

Singalia Lacordaire, 1872, Gen. Col. 9: 834 (type: *S. spinipennis* Lacordaire = *gibbosus* Pascoe).

Key to the species of Thranius

1. Elytra obviously dehiscent from before the middle, each generally less than one-half as wide behind middle as at base 2
   Elytra not obviously dehiscent before middle, at least one-half as wide just behind middle as at base 11

2 (1). Each elytron less than one-half as wide behind middle as at base 3

Each elytron about one-half as wide just behind middle as at base; elytra ochraceous, in part with very pale pubescence, with humeral area, a post-sutural triangle and a tapering stripe on third quarter, pitchy and glabrous; length 12.6 mm.; Sumbawa ..... **lanceolatus** Gressitt, n. sp.

3 (2). Body not almost entirely black and pitchy; ventral surfaces not black 4

Body almost entirely black and pitchy; antennae slightly paler at extreme apices; elytra pitchy with a reddish stripe on each near scutellum; length 10-12 mm.; Formosa ..... **infernalis** Matsushita

4 (3). Elytra without distinct markings 5

Elytra dark with pale markings or pale with dark markings 6

5 (4). Elytra uniform pale ochraceous, slightly darker on humeri, suddenly narrowed towards middle; frons squarish; prothorax broader than long; body dark brown; length 18 mm.; Amboina ..... **angustipennis** Pascoe

Elytra brown to dull ochraceous, more gradually narrowed; body reddish brown, in part paler; frons deeper than wide; prothorax about as broad as long; length 21 mm ..... **sumatrensis** Gahan

6(4). Elytra dark or brownish with pale markings 7

Elytra pale with dark markings; length 20 mm 9

7 (6). Elytra brown or pitchy with a few pale areas at bases 8

Elytra pitchy with many yellow spots: an anteriorly open lunule near humerus, a few small external posthumeral spots, and premedian spot and an elongate mark behind middle; antennae reddish basally; length 15 mm.; Tonkin ..... **multinotatus multinotatus** Pic

8 (7). Elytra reddish brown with three or four pale spots near base and some golden pubescence near scutellum; antennae pitchy distally with eighth segment paler; length 18-20 mm.; Taiwan, SE. China, Tonkin ..... **multinotatus signatus** Schwarzer

Elytra pitchy brown with base of each, except for an oblique parahumeral mark, and a narrow subtransverse band before middle, pale ochraceous; antennae reddish brown with eighth and ninth segments paler; length 15-21 mm.; Japan ..... **variegatus** Bates

9 (6). Antenna black; elytra without a common black spot behind scutellum 10

Antenna dark brown with first two segments and most of third reddish; elytra pale reddish brown to testaceous, with a dark brown spot behind scutellum, another on disc of each anterior to middle and a dark stripe on posterior portion of disc; each elytron with a sharp spine at apex; Tenasserim ..... **fryanus** Gahan

10 (9). Each elytron reddish, with a transverse black spot at base, a large rectangular spot at side a little behind base, and most of the apical half, black; disc of pronotum obtusely raised and asperate; Manipur ..... **triplagiatus** Gahan

Each elytron with a long apical spot branching anteriorly and meeting a premedian spot which also branches anteriorly and is prolonged on inner margin to base; Tonkin ..... **irregularis** Pic

11 (1). Prothorax much broader anteriorly than posteriorly 12

Prothorax not much broader anteriorly than posteriorly 13

12 (11). Elytra blackish brown with the basal fifth of each and a narrow transverse premedian band of yellowish brown; length 12 mm.; Mindanao ..... **ampliaticollis** Heller

Elytra brown with a vague basal paler area and distinct testaceous spot at center of each; length 13-17.5 mm. to elytral apex; Malacca, Borneo ..... **bimaculatus** Pascoe

13 (11). Pronotum not conspicuously raised on anterior portion of disc 14

Pronotum distinctly raised on anterior portion of disc 16

14 (13). Eighth and ninth antennal segments not pale, similar to others..... 15
Eighth and ninth antennal segments white; elytra entirely dull brown; antenna with third segment testaceous in middle and eighth and ninth segments white; elytra closely granulose-punctate; length 18 mm. (16 to elytral apex); Dorey.....**brunneus** Pascoe

15 (14). Elytra dark brown except for a pale brown basal area and a pair of premedian spots; antenna reddish brown basally, remainder dull brown, the eighth segment a little paler at base; length 11 mm.; Batchian.....**basalis** Pascoe
Elytra entirely purplish brown; antenna black; length 14-25 mm.; Taiwan .....**formosanus** Schwarzer

16 (13). Elytra not uniformly colored..... 17
Elytra uniformly colored..... 20

17 (16). Prothorax slightly longer than broad, the gibbosity somewhat laterally compressed anteriorly; eighth and ninth antennal segments not in very conspicuous color contrast to rest of antenna..... 18
Prothorax fully as broad as long, the gibbosity somewhat flattened on top; eighth and ninth antennal segments very pale and conspicuously contrasted to dark remainder of antenna; each elytron with a vague longitudinal pale mark near base and a subtransverse pale mark just anterior to middle; length 15.2 mm.; New Guinea.....**dentatipennis** Gressitt n. sp.

18 (17). Dorsum largely pitchy with paler markings..... 19
Dorsum pale reddish brown, with still paler, almost whitish, areas on middle and posterior portions of elytra; Sumbawa.....**lanceolatus** Gressitt n. sp.

19 (18). Elytra with distinct basal and median oblique pale bands; antennae largely reddish; pronotum gradually declivitous posteriorly; apex of each elytron sharply spined; length 12.5-22 mm.; S. India, Ceylon.....**gibbosus** Pascoe
Elytra with only a vague basal pale area; antennae largely dark castaneous; pronotum suddenly declivitous a short distance before base; apex of each elytron swollen above and briefly toothed; length 11.3 mm.; Solomon Is. .....**solomonensis** Gressitt n. sp.

20 (16). Body testaceous beneath; length of body generally under 14 mm..... 21
Body pitchy beneath; length of body over 15 mm..... 22

21 (20). Prothorax reddish testaceous; elytra densely and subconfluently punctured; length 14 mm.; S. Japan.....**rufescens** (Bates)
Prothorax reddish brown like elytra; elytra asperate-punctate; ventral surfaces testaceous; length 11-12.5 mm.; Java.....**pallidiventris** Gressitt n. sp.

22 (20). Body generally pitchy brown with parts of ventral surfaces testaceous..... 23
Body almost entirely reddish brown; eighth and ninth antennal segments pale buff; ventral surfaces of body uniformly reddish brown except for pitchy posterior margins of abdominal segments; elytral punctures somewhat asperate; pronotal gibbosity flattened on top; elytral apex singly acuminate; length 21-23 mm.; Java.....**fruhstorferi** Gressitt n. sp.

23 (22). Elytra densely punctured with front edges of punctures slightly raised; femora pale basally; length 15-27 mm.; Bhutan; Burma; W. China.....**simplex** Gahan
Elytra granulate; length 18-25 mm.; Laos.....**granulatus** Pic

Thranius ampliaticollis Heller, 1916, Deutsche Ent. Zeitschr.: 300, pl. 3, fig. 9.
Described from Butuan, Mindanao.

Thranius angustipennis Pascoe, 1869, Trans. Ent. Soc. Lond. (3) 3: 564.
Described from Amboyna.

Thranius basalis Pascoe, 1869, Trans. Ent. Soc. Lond. (3) 3: 564.
Known only from Batchian (Batjan), Indonesia.

Thranius bimaculatus Pascoe, 1859, Trans. Ent. Soc. Lond. (2) 5: 23, pl. 2, fig. 7; 1869, (3) 3: 563; Lacordaire, 1869, Gen. Col. 8: 471, pl. 90, fig. 4.

One (Brit. Mus.), Kuching, Sarawak, Borneo, Mar. 7, 1900 (1900-50). Three specimens (Calif. Ac. Sci.) from Kabasalan, Mindanao, Jan. and May, 1932 and Santa Fe, Bukidnon, Mindanao, 1000 met., May 1935, F. C. Hadden collection, are tentatively referred here, though they might possibly be *ampliaticollis* Heller in spite of differing in form and pattern from figure and description. Previously known only from Malacca.

Thranius brunneus Pascoe, 1869, Trans. Ent. Soc. Lond. (3) 3: 564.

Known only from Dorey in the Moluccas.

Thranius dentatipennis Gressitt, new species. Fig. 1.

Female: Reddish brown to testaceous or pitchy: head reddish, darker on mouthparts and median line of frons, clothed with very fine short moderately dense pubescence which is pale golden above and silvery at sides and very sparse, pale and with some longer hairs on under side; antenna dark reddish castaneous on first three segments, pitchy on remainder except for whitish testaceous eighth and ninth segments; prothorax reddish brown with very sparse pale hairs above and with very short silvery pubescence and long buff hairs at sides and beneath; scutellum dark reddish brown; elytra pitchy reddish brown, each with a vague longitudinal testaceous spot behind middle of base and a transverse testaceous band just anterior to middle, almost reaching suture and external margin; ventral surfaces reddish brown, ochraceous on metasternum and bases of ventral portions of abdominal sternites, pitchy on posterior portions of abdominal sternites, largely clothed with short sparse silvery pubescence and sparse long oblique goldish hairs; legs pale ochraceous, testaceous on femoral peduncles and castaneous on hind femoral club.

Head barely broader than prothorax, broadly concave between antennal supports, very finely granulose-punctate, with a glabrous raised double line along middle of frons. Antenna barely more than two-thirds as long as body, fairly stout; scape long, with many shallow punctures; third segment about as long as next two combined, sparsely pubescent; fourth and following subequal in length; last constricted at beginning of apical third. Prothorax slightly broader than long, generally swollen above but the gibbosity not strongly compressed laterally, nearly flat on top, briefly declivitous anteriorly and posteriorly; disc moderately granulose, with up to 20 granules in an approximate row across the middle and 25 or more in an approximate longitudinal row (irregularly arranged). Scutellum slightly longer than broad, narrowed behind, raised at sides and slightly arched in longitudinal sense. Elytra conjointly very little broader than prothorax; each elytron gradually narrowed to slightly behind middle where it is a little more than one-half as broad as at base, and thence parallel-sided to just before apex which is evenly narrowed to form a sharp tooth, but not a narrow spine as in many species; surface entirely asperate- or granulose-punctate with the granules more evenly convex and depressed posteriorly. Ventral surfaces minutely granulose-punctate on thorax and finely and sparsely punctured on abdomen. Legs slender; hind femora compressed, reaching to apex of fourth abdominal segment; first hind tarsal segment nearly as long as remainder combined. Length 15.2 mm.; breadth 3.6.

Holotype, female (U. S. National Museum), Hollandia, northern New Guinea, May, 1945, Boris Malkin collector; paratopotype (Calif. Ac. Sci.), February 10, 1945, S. G. Jewett.

Differs from *T. bimaculatus* Pascoe in being relatively shorter, with the pronotum more strongly raised anteriorly and the elytra less strongly asperate basally but more so apically.

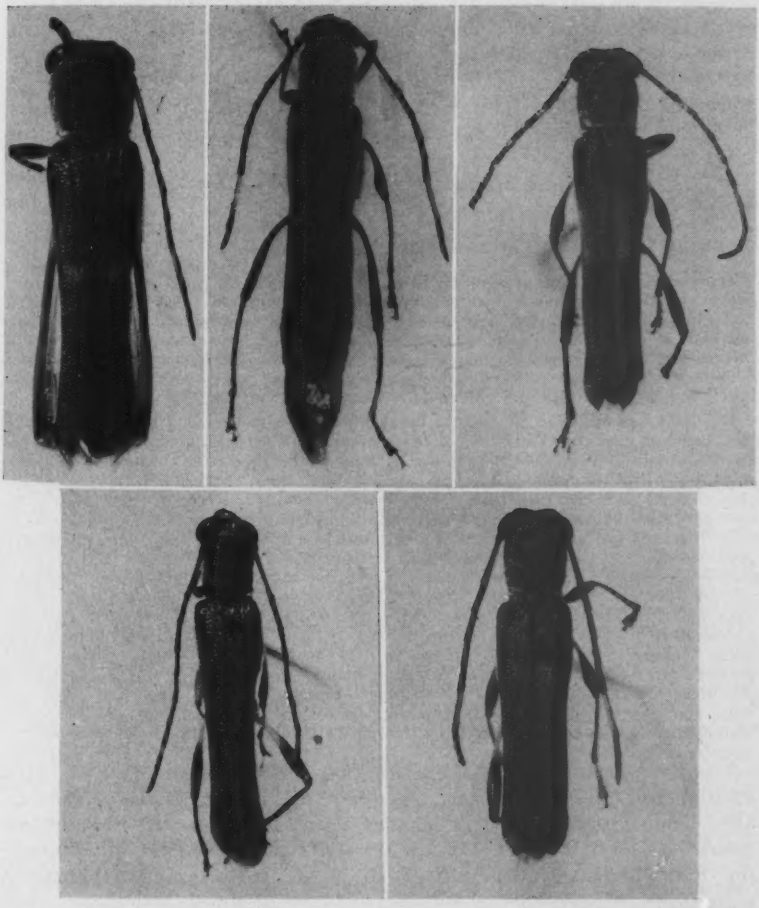


Fig. 1. **Thranius dentatipennis** Gressitt, n. sp. Paratype.
Fig. 2. **Thranius fruhstorferi** Gressitt, n. sp.
Fig. 3. **Thranius lanceolatus** Gressitt, n. sp.
Fig. 4. **Thranius pallidiventris** Gressitt, n. sp.
Fig. 5. **Thranius solomonensis** Gressitt, n. sp.

Differs from *T. gibbosus* Pascoe in having the prothorax shorter and broader with the gibbosity less compressed and less accentuated anteriorly, the body darker beneath, the antennae darker with the eighth and ninth segments paler and the elytra less extensively marked with pale and with the pubescence much less extensive.

Thranius formosanus Schwarzer, 1925, Ent. Blätter 21: 23; Matsushita, 1933, Jl. Fac. Agric. Hokkaido Univ. 34: 225; Gressitt, 1951, Longicornia 2: 182.

Known only from the western foothills of Taiwan.

Thranius fruhstorferi Gressitt, new species. Fig. 2.

Female: Reddish brown, paler on head, slightly darker on pronotum, dark reddish brown to pitchy on antennae with third segment pale externally before apex and eighth and ninth segments whitish yellow, castaneous on legs and pitchy red on posterior portions of abdominal segments; body sparsely clothed above with very short buff pubescence; several long hairs on inner side of apex of scape in a group arising from a single cavity; ventral surfaces with distinct fine silvery pubescence and long oblique buff hairs; legs with oblique golden buff hairs of varying length.

Head no broader than prothorax, finely granulose-punctate in front and distinctly punctured on gena; frons with two or three irregular raised lines along middle. Antenna stout, not quite three-fourths as long as body; scape gradually thickened, shallowly punctured; third segment as long as next two combined; sixth and following shorter than fourth or fifth. Prothorax large, slightly broader anteriorly than posteriorly, strongly raised above with the gibbosity somewhat compressed laterally but also somewhat flattened on top, declivitous at apex and just anterior to base; disc moderately granulose with as many as 20 granules in an approximate transverse row and up to 30 in the equivalent of a longitudinal row. Scutellum subparallel-sided, broadly rounded behind with margins raised and surface pubescence. Elytra conjointly a little broader than anterior portion of prothorax; dehiscent in about apical third; each gradually narrowed to about middle and then very slightly narrowed in apical half before apex; apex strongly acuminate, and almost in line with sutural margin; surface moderately asperate-punctate, the granules more nodose posteriorly. Ventral surfaces finely granulose-punctate, minutely so on abdomen. Legs fairly large; first hind tarsal segment about two-thirds as long as remaining combined. Length 21 mm. (26 to apex of abdomen); breadth 4.2 mm. Paratypes; length 22-23 mm.; breadth 4.4-4.6 mm.

Holotype, female, British Museum (Nat. Hist.), Pengalengan, W. Java, 1200 meters, H. Fruhstorfer; paratopotype, female (Paris Museum), 1893, Fruhstorfer; paratypes, females (Paris Museum and Philadelphia Acad. Nat. Sci.), Tengger Mts., at 1200 met., E. Java, 1890, H. Fruhstorfer. Paratype (Paris Museum), E. Java, M. Ardjoeno (Van Lansberge collection). Named for the collector of most of the material.

Differs from *T. sumatrensis* Gahan in being slightly more elongate, paler and with the elytra more or less parallel-sided in posterior portion, instead of being distinctly narrower postmedially than preapically. The pronotal disc is more declivitous posteriorly in *fruhstorferi*. Differs from *T. simplex* Gahan in being almost entirely reddish brown, with the ventral surfaces uniformly so, in having the third antennal segment pale preapically, the legs with only the trochanters pale, the scape sparsely or irregularly punctured, and the elytra dehiscent in apical third.

Thranius fryanus Gahan, 1906, Fauna Brit. India Col. 1: 238.
Known only from Tenasserim, Lower Burma.

Thranius gibbosus Pascoe, 1859, Trans. Ent. Soc. Lond. (2) 5: 23; Gahan, 1906, Fauna Brit. India Col. 1: 237, fig. 89.

One (Philadelphia Acad. Sci.) Nalanda, Ceylon, Apr.-June, Kannegieter; several (British Mus.) Andaman Islands, Annamalai Hills and Malabar, South India. Described from Ceylon and recorded by Gahan from the Nilgiri Hills, S. India.

Thranius granulatus Pic, 1922, Mel. Exot. Ent. 37: 11.

Described from Laos, Indo-China. This form needs to be better distinguished from *T. simplex* Gahan.

Thranius infernalis Matsushita, 1933, Jl. Fac. Agric. Hokkaido Univ. 34: 225; Gressitt, 1951, Longicornia 2: 182.

Known only from medium altitudes in the central part of Taiwan.

Thranius irregularis Pic, 1927, Mel. Exot. Ent. 49: 28.

Described from Chapa, northern Tonkin, Indo-China.

Thranius lanceolatus Gressitt, new species. Fig. 3.

Male: Largely pale ochraceous, in part marked with pitchy: head reddish ochraceous, with silvery buff pubsecence on gena and long erect buff hairs on frons and under side; antenna entirely reddish ochraceous, slightly darker at apices of third to fifth segments, moderately golden pubescence; erect hairs at end of scape slightly scattered and not very contrastingly longer than other hairs on scape; prothorax distinctly reddish, sparsely pubescent above and densely clothed with silvery buff hairs lying in different directions, as well as fine erect buff hairs, on sides and sternum; scutellum densely clothed with golden buff pubescence; elytra distinctly clothed with short silvery buff pubescence and each glabrous and slightly pitchy on an elongate humeral-posthumeral area, a shorter common postscutellar area and a narrow tapering stripe on third quarter occupying most of outer two-thirds of disc; ventral surfaces ochraceous, paler on abdomen, with fairly dense silvery pubescence and long erect silvery buff hairs; legs reddish ochraceous, paler on tarsi and femoral peduncles, moderately clothed with oblique buff hairs of varying length.

Head broader than prothorax; frons strongly reticulate-punctate with a pair of subsinuous median raised lines; occiput more finely or irregularly reticulate-punctate or granulose; gena closely punctured; postgena sparsely granulose. Antenna fully three-fourths as long as body, fairly slender; scape not very long, slightly arched, irregularly but fairly closely punctured; third as long as next two combined; fifth to tenth decreasing slightly in length; last longer and slender. Prothorax little longer than broad, slightly broadened anteriorly, moderately swollen above, the gibbosity not strongly compressed laterally, somewhat flattened on top, densely granulose anteriorly and sparsely so posteriorly, somewhat declivitous at anterior end and feebly so posteriorly. Scutellum parallel-sided, broadly rounded behind. Elytra conjointly somewhat broader than anterior portion of prothorax, dehiscent from basal sixth; each gradually narrowed to just behind middle where it is barely more than one-half as broad as at base, then subparallel-sided though bending slightly outwards, very slightly broadened just before apex which is suddenly narrowed and then produced into a slender spine; disc asperate-punctate with the anterior raised edges of punctures somewhat overhanging the punctures, a little less so posteriorly. Ventral surfaces finely punctured. Legs rather small; tarsi relatively broad; hind tarsus with first segment slightly longer than last segment. Length 12.6 mm.; breadth 2.9.

Holotype, male (Philadelphia Academy of Natural Science), Sumbawa, Indonesia, Grelak collector.

Differs from *T. angustipennis* Pascoe in having each elytron slightly more instead of less than one-half as wide just behind middle as at base, the elytra with pale pubescence and dark markings instead of uniform, and the antennae and the femora without contrasted coloring. Somewhat similarly marked to *T. fryanus* Gahan, but having the elytra much broader in postmedian portion.

Thranius multinotatus multinotatus Pic, 1922, Mel. Exot. Ent. 36: 22.

Described from Tonkin. One specimen from Hoa-binh, Tonkin, in Lepesme collection.

Thranius multinotatus signatus Schwarzer, 1925, Ent. Blätter 21: 23; Matsushita, 1933, Jl. Fac. Agric. Hokkaido Univ. 34: 225; Gressitt, 1939, Notes d'Ent. Chinoise 6: 99; 1951, Longicornia 2: 182.

Known from Taiwan (central foothills) and hill country of southeastern China (Chekiang, Fukien and Kwangtung). May be a synonym rather than a subspecies.

Thranius pallidiventris Gressitt, new species. Fig. 4.

Male: Largely pitchy reddish above and pale beneath: head reddish brown, darker along median line of frons and vertex, clothed with fine golden buff pubescence above and silvery buff at sides, with scattered erect hairs; antennae dark reddish brown, slightly paler on central portion of third segment only, moderately clothed with golden buff pubescence except on first two segments; scape with a small group of long hairs on inner side of apex forming a "pencil"; prothorax dark reddish brown with granules pitchy, moderately clothed with buff pubescence above and more densely clothed with silvery buff beneath and at sides; scutellum reddish with dark border, moderately pubescent; elytra dark reddish brown, nearly pitchy, sparsely and evenly clothed with fine pale buff pubescence; ventral surfaces pale testaceous, slightly reddish on thoracic pleura, clothed with thin silvery buff pubescence and scattered fine oblique hairs; legs ochraceous with femoral peduncles testaceous and tibia and femoral club of hind leg castaneous.

Head distinctly broader than prothorax, finely granulose on frons and occiput, a raised median line, in part double, on frons and vertex; gena punctured. Antenna nearly five-sixths as long as body, slender; scape slender, sparsely punctured; third segment not quite as long as next two segments combined; fifth to tenth decreasing very slightly in length; last slightly longer. Prothorax barely longer than broad, very slightly broadened anteriorly, moderately swollen above with the gibbosity somewhat laterally compressed, moderately granulose anteriorly and sparsely so posteriorly. Scutellum narrow, subparallel-sided, rounded behind, raised at sides, feebly roughened. Elytra a little broader than anterior portion of prothorax, dehiscent in apical sixth; each gradually narrowed to behind middle where it is more than one-half as broad as base, then almost subequal in breadth until narrowed to form the moderately spined apex; surface subasperate-punctate with the granules small anteriorly and depressed and subnodose posteriorly. Ventral surfaces finely punctured. Legs slender; femora clubs weak; hind tarsus with first segment about as long as last. Length 12.5 mm.; breadth 2.3.

Paratype: length 11 mm.; breadth 2.1.

Holotype, male (Philadelphia Academy of Natural Science), Tengger Mts., alt. 1200 met., E. Java, Indonesia, H. Fruhstorfer collector; paratopotype (Gressitt collection, Calif. Acad. Sci.), same data; paratopotype (Riksmuseum, Stockholm), same data.

Differs from *T. rufescens* (Bates) in being uniformly brown above and very pale beneath, and in having the elytra somewhat asperate. Differs

from *T. brunneus* Pascoe in being smaller, in having the pronotum gibbose, the antennae with the eighth and ninth segments not pale, the ventral surface pale instead of chestnut brown, and the legs paler.

Thranius rufescens (Bates), 1884, Jl. Linn. Soc. Zool. 18: 258 (Singalia); Mitono, 1940, Cat. Col. Jap. 8: 58.

Known only from Kyushu, Japan.

Thranius simplex Gahan, 1894, Ann. Mus. Civ. Genova 34: 15; 1906, Fauna Brit. India Col. 1: 237; Gressitt, 1938, Lingnan Sci. Jl. 17: 152; 1951, Longicornia 2: 183.

Several (Paris Museum) Bhutan (Bootang): Maria Basti, 1898, L. Durel; Pedong, A. Desgodins.

Known from Bhutan, Burma and West China (Sikang).

Thranius solomonensis Gressitt, new species. Fig. 5.

Female: Body largely dark pitchy, in part paler: head reddish brown, pitchy on occiput and along middle of frons and vertex, sparsely clothed with pale buff hairs above and silvery buff beneath; antennae somewhat shiny dark reddish brown basally, duller distally, wtih eighth and ninth segments ochraceous, moderately clothed with golden brown pubescence; scape with a fine apical "pencil" of hairs; prothorax dark pitchy brown, sparsely clothed with fine golden buff pubescence above and denser silvery buff beneath; scutellum dark, moderately golden pubescence; elytra dark pitchy red-brown with a vague reddish postbasal area, sparsely clothed with fine golden pubescence; ventral surfaces dark reddish brown, more pitchy at sides and on posterior borders of abdominal sternites, moderately clothed with thin silvery buff pubescence and strongly oblique golden buff hairs; legs reddish brown with femoral peduncles testaceous and hind femoral club castaneous; femora with sparse short hairs.

Head distinctly broader than prothorax, irregularly rugulose-punctate, grooved along middle of frons and vertex, hardly punctured on gena. Antenna nearly five-sixths as long as body; scape slightly arched, feebly and irregularly punctured; third segment not quite as long as next two combined; sixth to tenth subequal; last barely longer, feebly constricted preapically. Prothorax slightly longer than broad, hardly widened anteriorly, moderately swollen above, the gibbosity hardly compressed laterally, fairly even above, slightly depressed behind center, moderately declivitous anteriorly and posteriorly. Scutellum narrow, narrowed and rounded posteriorly, concave and finely punctured. Elytra a little broader than prothorax, dehiscent in about apical fifth; each gradually narrowed to behind middle where it is more than one-half as broad as base, then very slightly narrowed till just before apex which is swollen above and suddenly and briefly acute; surface distinctly granulose-punctate, somewhat asperate basally. Ventral surfaces finely punctulate. Legs moderately stout; tarsi fairly broad. Length 11.3 mm.; breadth 2.5 mm.

Holotype, female (Bishop Museum), Guadalcanal, Solomon Islands, February 1945, J. R. Stuntz collector. Presented to Bishop Museum by Ohio State University, through kindness of Prof. Joseph Knull. Another (Calif. Ac. Sci), Piva, Bougainville I., Solomons, Dec. 1944, A. J. Waltz.

Differs from *T. basalis* Pascoe in having the prothorax distinctly broadened anteriorly, the elytra broader postmedially, and more suddenly acute apically. Differs from *T. gibbosus* Pascoe in being smaller with slightly shorter body, stouter antennae and legs, darker antennae, more uniformly marked elytra with only a vague basal pale area, and in having the apex of each elytron swollen above and briefly acute.

Thranius sumatrensis Gahan, 1895, Ann. Mus. Civ. Genova (3) 3: 71.

One (Paris Museum) Kepahian, Sumatra, Van Lansberge collection; one (Lepesme collection), Si-Rambe, Sumatra, Dec. 1890 to Mar. 1891, E. Modigliani. Known only from Sumatra.

Thranius triplagiatus Gahan, 1906, Fauna Brit. India Col. 1: 238.

Known only from Manipur, North India.

Thranius variegatus Bates, 1873, Ann. Mag. Nat. Hist. (4) 12: 196; Matsushita, 1933, Jl. Fac. Agric. Hokkaido Univ. 34: 225.

Known from Japan (Hokkaido, Honshu, Kyushu). The record for Taiwan is questionable.

Notes and Descriptions on Australian Fruit Flies (Diptera: Tephritidae)[1]

By D. ELMO HARDY[2]

HONOLULU, T. H.

Since the publication of my report dealing with the Australian fruit flies collected by N. L. H. Krauss (Hardy, 1951) a few additional records have turned up in the Krauss collection and I have also had an opportunity to make further studies of some of the Australian fruit flies. Specimens of an apparently new genus and species have been at hand for some time. This is described herein and I am recording the additional Krauss records and some further descriptive information.

The drawings have all been made by my assistant, Marian S. Adachi. Her help in this respect is greatly appreciated.

Austromyia new genus

A series of specimens received from the Australian Museum appears to represent an undescribed genus and species. They are quite strikingly different from anything which I have seen in the literature or any group of fruit flies with which I am acquainted. Following Hering's classification of the subfamilies and tribes of the fruit flies (1947:13) it would fit in the subfamily Oedaspinae and because of the elongate basal segment of the ovipositor (seventh abdominal segment) would fall into his tribe Cecidocharini. It does not appear to be related to any of the members of this tribe which I have examined. In Hendel (1927:20), Shiraki (1933:126), Bezzi (1920:7) and Zia (1937:127) it runs imperfectly to *Oedaspis* Loew. I am unable to find any characters which would indicate that this is closely related to *Oedaspis* and I think the apparent relationship is misleading. It differs from *Oedaspis* in many ways. The front is not so broad, it is about one and two-fifths times longer than wide (measured from the lunule to the lower ocellus), and is just slightly wider than one eye (fig. 1b), from a direct dorsal view. In *Oedaspis* the front is about one and one-fifth times wider than long and two times wider than one eye (fig. 2b). No distinct inferior fronto-orbital bristles are present (fig. 1a). In *Oedaspis* three pairs are developed. The lunule is much more strongly developed in *Oedaspis* (figs. 2a and 2b). The eye shapes and the development of the genae are quite different, as shown in figures 2a and 1b. The hairs of the occipital row are black in *Austromyia* and are yellow in *Oedaspis*. The dorsocentral bristles are situated well behind the anterior supra-alar bristles on *Austromyia* and are on or near a line drawn between these bristles in *Oedaspis*. Because of this character *Austromyia* runs to couplet 71 of Hendel's key (1914:85) with *Acidia* Robineau-

[1] Published with the approval of the Director of the Hawaii Agricultural Experiment Station as Technical Paper No. 304.

[2] Entomologist, University of Hawaii Agricultural Experiment Station.

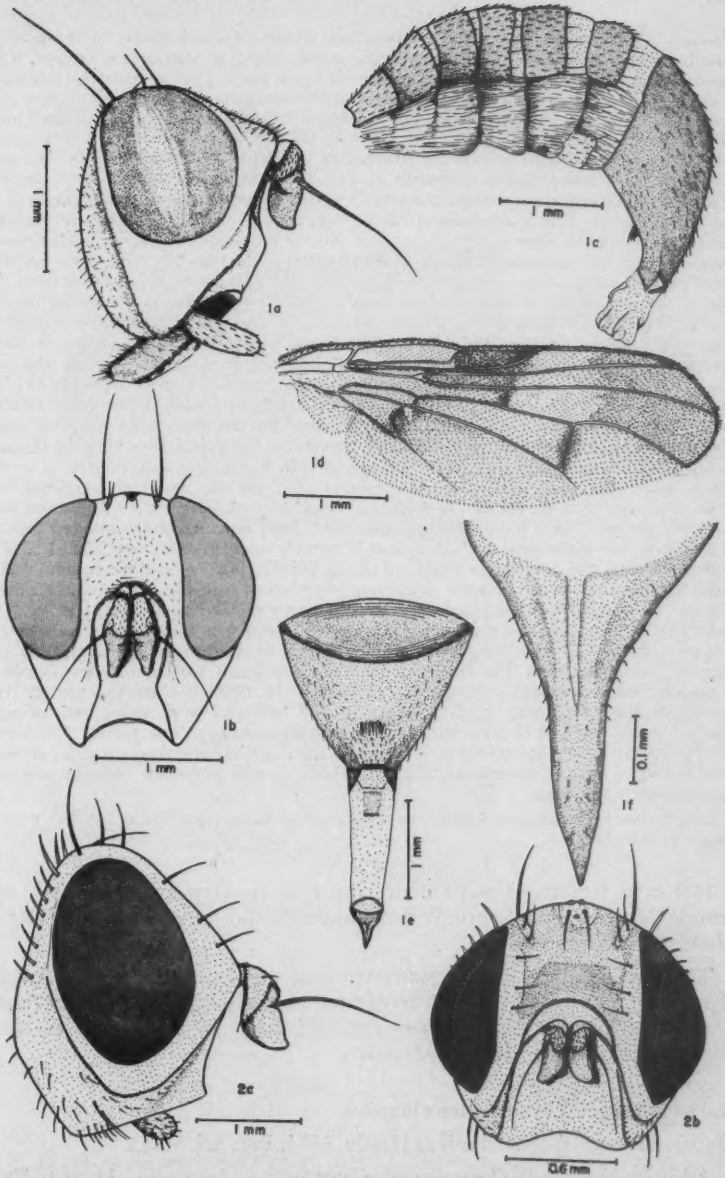
Desvoidy and *Phorellia* Robineau-Desvoidy (= *Trypeta* Meigen). It is, however, very different from these genera and seems to fit better near *Oedaspis*. In Malloch's key (1939:442) it runs to couplet 13, near *Pseudina* Malloch. His genus is distinguished by having four pairs of fronto-orbital bristles, placed on the upper three-fifths of the front, with the superior fronto-orbitals poorly developed and tiny compared to the inferior fronto-orbital bristles; as well as in other details.

Superficially this genus resembles *Ortalotrypeta* Hendel, at least in many of the details of the head and in the wing pattern. It differs by having three anterior supra-alar bristles, not four; the dorsocentrals placed well behind a line drawn between the anterior supra-alar, not near it; only one pair of humeral bristles, not two to three pairs; the ocellar bristles weak, not equal to or larger than the superior fronto-orbitals; no distinct inferior orbitals (see discussion below, and fig. 1b); no genal bristle present and vein R_{4+5} bare.

Aside from the above mentioned characters the generic details are as follows: front moderately broad, about equal in width to one eye, and slightly expanded anteriorly (fig. 1b). Two pairs of superior fronto-orbital bristles are present, these are at least two times longer and stronger than are the ocellar bristles. The inner and outer vertical bristles are well developed but the postverticals are lacking. No distinct inferior fronto-orbitals are present; a few rather strong hairs are on the lower portion of the front near the lunule but these are not in the normal position for inferior fronto-orbitals. The head is produced at the bases of the antennae; at this point it is about one-third as wide as the eye. The genae are well developed and are about one-half as high as the eye, and the oral margin recedes rather sharply behind. The arista is short pubescent and the third antennal segment is slightly pointed at apex. The eye is suboval in shape (fig. 1a). The chaetotaxy of the thorax is as follows: four to six scutellars (four appears to be normal); two prescutellars; two dorsocentrals, situated slightly posterior to the prescutellars; two pairs of posterior notopleurals (on the callus) and one pair of anterior notopleurals; two pairs of outer scapulars; no propleurals (the area is covered with numerous black hairs); four or more bristles on the hind margin of the mesopleura; one pteropleural and one sternopleural. Vein R_{1+2} is bristly to the node; the other veins except the costa are bare. The lower portion of the cubital cell is produced into a short acute point (fig. 1d). The basal segment of the ovipositor is strongly developed and curved downward, it is about equal to the combined lengths of abdominal segments two to six (fig. 1c).

Austromyia neglecta new species (Figs. 1a-f)

Possessing the following characters in addition to the details given above. *Head:* Less than one and one-third times higher than long. The occiput is rather strongly swollen on the lower portion but the vertex is narrow (fig. 1a). The vertex and the portion of the front bearing the superior fronto-orbital bristles is reddish brown, the remainder of the front is largely rufous except for the yellow sides. The head is otherwise yellow except for the dark brown to black eyes and the appendages. The first two antennal segments and the palpi are rufous, the third segment is brown to black and is about three-fifths as wide as long. The oral margin and genae lack strong hairs or bristles. The face is very slightly convex as seen in direct lateral view. *Thorax:* Largely reddish



1. **Austromyia neglecta** n. sp. a. head, lateral view; b. head, front view; c. abdomen, lateral view; d. wing; e. extended ovipositor; f. piercer of ovipositor.

2. **Oedaspis dorsocentralis** Zia and Chen. a. head, lateral view; b. head, front view.

brown, obscurely blackish on the dorsum, and yellow on the humeri, on margins of scutellum and on metapleura. Just two (the outer) scapular bristles are present. The propleura have no bristles but possess numerous black hairs. The mesopleura each have a row of four or more black bristles along their hind margins. Each sternopleuron and pteropleuron has one strong bristle. The scutellum appears typically to have four marginal bristles; in some specimens, however, a small pair is present between the strong bristles. The dorsocentral bristles are situated in line with the prescutellar bristles and just slightly in front of the posterior supra-alars. *Wings:* The third costal section (stigma) is distinctly shorter than the second and is approximately one-half as long as the third section. The wings have a brown infuscation extending vertically through the middle from the costa to vein M_{1+2} over the r-m crossvein. The apex is also extensively brown; this coloration extends over the m crossvein (fig. 1d). Vein R_{1+2} and the basal portion of R_{4+5} are setulose; the latter has but two to six small setae near the base of the vein. The r-m crossvein is situated slightly beyond the middle of cell 1st M_2. The cubital cell is developed into a short point at its lower apex. *Legs:* Rufous, slightly tinged with brown on the hind femora. The front femora each have twelve or more moderately strong bristles extending nearly the full length of the segment on the posterodorsal (extensor) surface; these are arranged in two rows. A series of flexor bristles extends the full length of the ventral surface of the front femur. The middle femora have a few weak extensor bristles on the apical half but the flexors are not developed. The hind femora have three to four dorsal bristles on the apical two-thirds of the segment. The middle tibiae each have two apical spines, one is much shorter than the other. *Abdomen:* Predominantly yellow-brown with no distinct black markings but often with the basal halves of the segments blackish. *Ovipositor:* Very large and conspicuous, the basal portion is polished brown, is about equal to the combined lengths of the first five abdominal segments and is sharply curved downward (fig. 1c). The undersurface of the base has a clump of strong bristles just beyond the middle and a small bar-like portion at the apex containing two rows of scale-like teeth (fig. 1e). From a dorsal or ventral view the basal segment is strongly tapered from base to apex. The basal portion is about 1.64 mm. wide, the apex is about 0.08 mm. wide. The segment is approximately 2.08 mm. long and the spiracles are situated about 0.52 mm. from the anterior lateral margins. The inversion membrane is about 1.04 mm. long; no rasper is present but a remnant of a sclerite appears to be developed on the venter. The piercer is about 0.55 mm. long, is broad at the base (0.4 mm. wide) and strongly tapered to the apex (0.12 mm. wide at the oviduct opening). The piercer has a row of strong setae on the lateral margins of the median portion and has two pairs of setae near the apex beyond the oviduct (fig. 1f). The extended ovipositor (fig. 1e) measures approximately 3.67 mm.

Length: body (including ovipositor of female to the down curved portion) 6.8-7.2 mm.; wings, 7.5-8.0 mm.

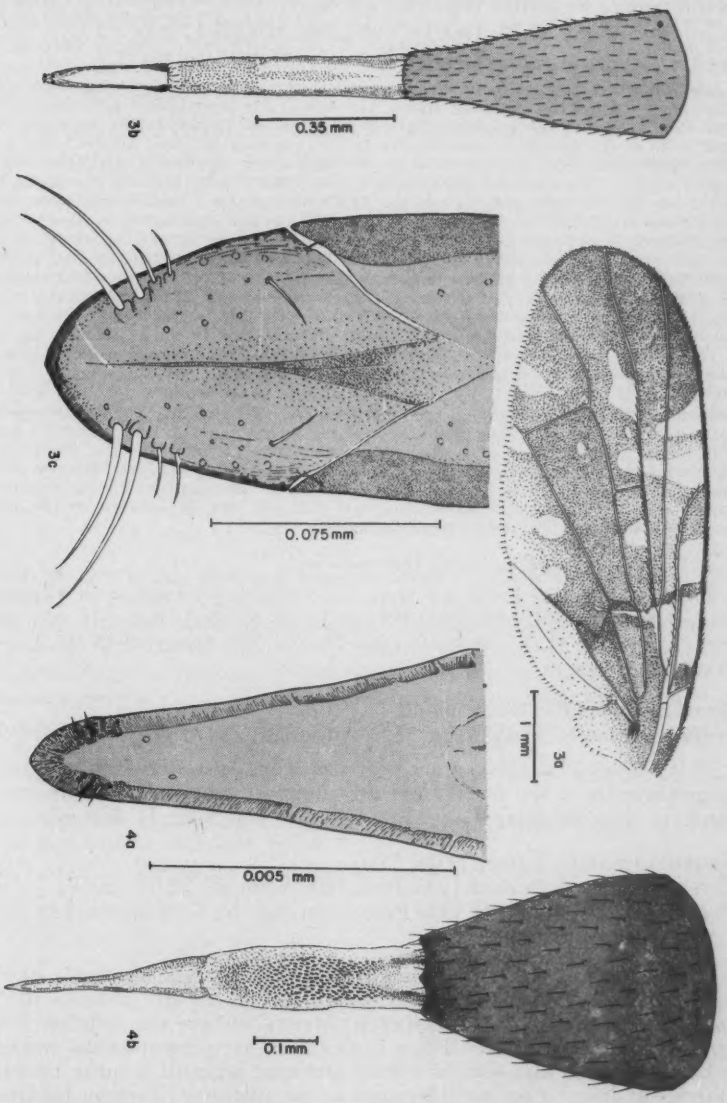
Holotype female, allotype male, and four paratypes, three males, one female, Tuross, New South Wales, Australia, January 17-22, 1936 (K. C. McKeown). No host given.

The type, allotype and one paratype have been returned to the Australian Museum at Sydney. Two have been deposited in the United States National Museum and one is at the University of Hawaii, to be later deposited in the B. P. Bishop Museum.

Dacus (Strumeta) breviaculeus Hardy

Dacus (Strumeta) breviaculeus Hardy, 1951. Pac. Sci. 5:145.

Additional record: Garradunga, Queensland, Australia, August, 1949, ex fruit of *Glochidion harveyanum* (N. L. H. Krauss).



3. **Acanthoneura australina** Hendel. a. wing of male; b. extended ovipositor; c. apex of piercer.

4. **Platensina malaita** Curran. a. apex of piercer; b. extended ovipositor.

Acanthoneura australina Hendel (Figs. 3a-c)

Acanthoneura australina Hendel, 1928. Ent. Mitteil. 17:359.

Acanthoneura australina Hendel, Hardy, 1951. Pac. Sci. 5:171.

Additional specimens of this species have been studied and the following notes will supplement the descriptions cited above. The species has been known previously only from the female but the ovipositor has not been studied in detail. The male fits the description of the female in most details. In the specimen at hand, however, the size and arrangement of the hyaline marks in the wings differ slightly (fig. 3a). The wedge-shaped mark on the wing margin extends into cell R_5, just beyond the r-m crossvein. In the female this mark ends in cell R_5. The second wedge-shaped spot extends into cell R_5, not ending at vein R_5 as in the female. The round spot in cell R_5, before the r-m crossvein, is as broad as the cell and is situated less than its own length from the r-m crossvein. In the female this spot is rather tiny and is about four times its length from the r-m crossvein. The spot in the median portion of cell R_5 extends dorsad to the underside of vein R_{4+5}, it is three-fourths as wide as cell R_5, is longer than wide and is extended into a point on its apical portion (fig. 3a). In the female this spot is isolated in the middle of the cell, is much smaller and oval in shape (refer to fig. 25, p. 171, Hardy, 1951). *Ovipositor: In situ* the visible portion of the ovipositor is longer than the remainder of the abdomen. The extended ovipositor measures about 4.6 mm. The piercer is approximately 0.92 mm. by 0.15 mm. at its widest point. The apex is very blunt and has two large and two tiny preapical setae (fig. 3c). The oviduct opens about 0.18 mm. from the apex. The inversion membrane is about 1.6 mm. by 0.3 mm. at its widest point. The rasper is situated approximately 1.0 mm. from the base of the segment. The basal segment of the ovipositor is comparatively long and narrow. It is about 2.08 mm. long by 0.85 mm. measured across its base and 0.33 mm. measured across its apex. The spiracles are situated very near the base of the segment (fig. 3b), about 0.05 mm. from the anterior lateral margins.

Type locality: Cairns, North Queensland.

The specimens at hand are from the following localities in Queensland: near Kuranda, May 29, 1949 (N. L. H. Krauss); Babinda, November, 1949 (N. L. H. Krauss) and near Deeral, November, 1949 (N. L. H. Krauss).

Paroxyna sororcula (Wiedemann)

Trypeta sororcula Wiedemann, 1830. Aussereur. Zweifl. Ins. 2:509.

This species probably occurs over much of Australia; it has a wide range throughout the tropics and subtropics of the world. Specimens at hand are from Brisbane, Queensland, May, 1949 (N. L. H. Krauss).

Platensina malaita Curran (Figs. 4a-b)

Platensina malaita Curran, 1936. Proc. Cal. Acad. Sci. 22 (1) :29.

Platensina dubia Malloch, 1939 Proc. Linn. Soc. N. S. Wales 64 (3-4) :459.

New synonymy.

I am unable to find differences which will separate Malloch's *dubia* from *malaita* Curran. Malloch distinguished it by the presence of "a small dark brown mark between each antenna and eye not mentioned by Curran in his description." These brown spots are present in the *malaita* at hand. Malloch also says "the third antennal segment is quite broadly rounded at apex." I see no differences in the antennae of specimens from Australia and New Hebrides. He says "the stigma has a much narrower hyaline mark at base than in that species [*malaita*], and the hyaline spot near the base of the first posterior cell is much smaller than in *malaita*."

I find no differences in these details in the specimens at hand, they all differ slightly from Curran's figure 1, plate 1, in that the third section of the costa (stigma) has just a small hyaline spot on the upper margin at the base, not a narrow hyaline streak extending across the base of this section; this slight difference does not appear to be of any importance.

The ovipositor has not previously been described.

When fully extended (fig. 4b) it measures approximately 2.4 mm. The piercer tapers rather gradually from base to apex and measures about 0.75 mm. by 0.13 mm. at its widest point. Two pairs of very minute preapical setae are present, these are visible only under oil immersion (fig. 4a). The oviduct opens about 0.08 mm. from the apex of the piercer. The inversion membrane is about 0.72 mm. long by 0.2 mm. wide. The rasper possesses very strong, conspicuous teeth which extend almost to the base of the segment, although the teeth diminish in size as they extend basad. The basal segment of the ovipositor measures about 0.92 mm. by 0.65 mm. at its widest point and the spiracles are situated 0.23 mm. from the anterior lateral margins of the segment.

Type locality: Tai Lagoon, Malaita Island.

Type in the California Academy of Science collection.

Malloch's *P. dubia* was from Gordonvale, N. Queensland. I have studied specimens from Espiritu Santo I., New Hebrides, August, 1943 (W. Bauer) and near Deeral, Queensland, June 24, 1949 (N. L. H. Krauss).

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A Revision of the Psychodidae of the Hawaiian Islands (Diptera)

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A revision of the Psychodidae of the Hawaiian Islands was undertaken to provide a more detailed picture of the psychodid fauna and to clarify the identity of the species upon which biological information is available. The present study has brought out that the existing lists of Hawaiian Diptera (Bryan, 1934; Hardy, 1952) are incomplete and list less than half of the species present. The biological studies of Hawaiian aquatic insects by Williams (1943) give informative accounts of several psychodids, but, with the exception of *Telmatoscopus albipunctatus*, the identity of the species with which he was dealing has been uncertain. Furthermore, there is reason to doubt if many of the references to *Psychoda alternata* and *P. inornata* are based upon correctly determined specimens, since many specimens which I have examined were incorrectly identified. *Psychoda alternata* has been confused with *P. pseudalternata* and the name *P. inornata* applied to several undescribed species. It is hoped that this revision will give a clearer understanding of the species which Williams studied and thus make possible more accurate cataloguing of his information.

There are but three genera of the family Psychodidae represented in the Hawaiian Islands, *Trichomyia, Telmatoscopus,* and *Psychoda. Trichomyia* is an archaic genus with relatively few species scattered over the world. *Telmatoscopus* and *Psychoda* are among the larger genera of psychodids and are also widely distributed throughout the world. Absent from the Hawaiian fauna are any members of *Pericoma* and *Phlebotomus* which are on the same level in the number of species they contain as *Telmatoscopus* and *Psychoda.*

Of the fourteen recognized species present seven are restricted in distribution to the Islands. At least two other undescribed species are also endemic (inadequate series precludes their naming at this time). Of the remaining seven, two species, *Telmatoscopus albipunctatus* and *Psychoda alternata,* are cosmopolitan in distribution. *Psychoda inornata* is a common species in North America and Europe and may be more widely distributed than the records indicate. Two species are known only from the Hawaiian Islands and the American mainland; the remaining two have been found in the Islands and Australia and New Zealand.

The type localities of two species herein described as new are found in California and in Florida and the West Indies. These species were discovered during a current study of North American psychodids, which is not yet ready for publication. The series upon which I prefer to base the original descriptions are from North America. Hence the apparent inconsistency of describing Nearctic species in a work concerned with the Hawaiian fauna.

Most of the specimens studied were received from Dr. D. Elmo Hardy of the University of Hawaii. Mr. C. E. Pemberton loaned the psychodid

collection of the Hawaiian Sugar Planters' Association, which contained many of the specimens Williams used in his aquatic studies. Mr. W. F. Rapp, Jr. made available the psychodids which Dr. W. W. Wirth had collected in the Islands. I am indebted to these gentlemen for providing me with this material.

Nearly all the specimens examined during this study were whole mounts on microscope slides. All measurements were taken from these slides. The specimens were cleared in 5% sodium hydroxide, washed in distilled water, dehydrated in methyl cellosolve, and mounted in euparal (diaphane). All locality records are based on slide-mounted specimens, with the exception of *Telmatoscopus albipunctatus*, which is a large and conspicuous species. It is felt by this author that positive identification of most species of the Psychodidae cannot be made on either pinned or alcohol material.

Certain terms employed may not be clear to all users of this revision. Those terms which might lead to confusion are defined. The *teeth* of the labellum are modified setae found on the apical margin of the flattened labellum of most species of the genus *Psychoda*. They are parallel-sided or nearly so and blunt at the apex. They should not be confused with spines or setae which taper from the base to an acute apex. The *sensory filaments* are lightly sclerotized structures found on the unmodified flagellar segments. They are usually Y-shaped in the genus *Psychoda*, but U-shaped, a single rod, or other shapes in different groups. The filaments are paired and arise from the apical portion of the flagellar node. The terminology of the wing venation is after Tonnoir (1935) employing the Comstock-Needham terminology. The anterior fork is bifurcation R_{2+3} and the posterior fork bifurcation M_{1+2}.

Few terms are used in describing the male and female genitalia, since I rely mainly on the illustrations of these structures to convey the impression of their characteristics. The female *subgenital plate* is the ninth sternite situated ventrad of the ovipositors or *cerci*. The appendages of the male genitalia are termed the *surstyli* and *coxites*. After rotating through 180° the surstyli are the ventral appendages and usually bear at their tips one or more spatulate or otherwise modified bristles, termed *tenaculae*. The coxites are the dorsal appendages after rotation and are composed of a proximal *basistyle* and apical *dististyle*. The *aedeagus* originates within the eighth segment and passes posteriorly at the level of the base of the coxites. It is highly variable in structure and may be a simple shaft or an asymmetrical, multipartite structure. The *ninth tergite* is a broad, quadrate plate ventrad to the coxites and aedeagus. The surstyli arise from its posterior lateral corners.

Key to Genera

1. R_5 present, hence two longitudinal veins between bifurcations R_{2+3} and M_{1+2}; palpus with 4 segments 2
   R_5 absent, hence one longitudinal vein between bifurcations R_{2+3} and M_{1+2}; palpus with 3 segments ..... **Trichomyia**
2. Antenna with flagellar segments equal in size, apical segment not reduced, bearing long, slender apiculis ..... **Telmatoscopus, T. albipunctatus**
   Antenna with one to three apical segments reduced in size, reduced segments about one-half size of preceding segments, without apiculis ..... **Psychoda**

Genus Trichomyia Curtis

Trichomyia Curtis, 1839, Brit. Ent., 16(186):745.

Adult characters. *Eyes* round, without eye bridge, interocular suture absent; labellum bulbous, without teeth; palpus with three segments. *Antenna* with 16 segments; flagellar segments pyriform, elongate pyriform or cylindrical, never nodose; apical flagellar segment very small, knob-like; sensory filaments simple, rod-shaped. *Wing* broadly rounded at apex; Rs 3-branched, R_5 absent, hence 1 longitudinal vein between bifurcations R_{2+3} and M_{1+2}; Sc forked, usually ending in C and R_1.

Type of genus: *Trichomyia urbica* Curtis (by monotypy).

The genus *Trichomyia* is the only representative of the subfamily Trichomyiinae in the Hawaiian Islands. This primitive genus is a small, widely distributed group not clearly associated with any single zoogeographic region.

This group is easily separated from other psychodid groups in that the radial sector is three-branched producing but one longitudinal vein between the forks of R_{2+3} and M_{1+2}. Also, the round eyes without median eye bridges are distinctive.

Key to Species of Trichomyia

1. Aedeagus of male genitalia enlarged distally, not strongly curved; spermathecal ducts of female longer than basal mid-piece of subgenital plate; R_{2+3} broken a short distance before base ..... **hawaiiensis** n.sp.
   Aedeagus of male genitalia slender distally, strongly curved; spermathecal ducts of female shorter than basal mid-piece of subgenital plate; R_{2+3} may be weakened at base, but not broken before base ..... **oahuensis** n.sp.

Trichomyia hawaiiensis new species (Figs. 9a-d)

Male. *Head:* eyes separated by distance equal to 11 facet diameters at level of antenna; labrum as long as first palpal segment; palpus as figured, 3-segmented, first segment with pit on inner margin, tuft of hairs arising from pit, ratio of segments 8:4:5. *Antenna* (terminal segments lacking) sensory filaments about 1½ times as long as segments bearing them, moderately sinuous, flagellar segments elongate pyriform, 2.4 times as long as wide. *Wing* as figured; R_{2+3} broken short distance from base, R_{4+5} with base lacking. *Genitalia* as figured.

Measurements: holotype, wing length 1.8 mm.; wing width 0.7 mm. Paratypes, wing length 1.5-1.7 mm.; wing width 0.6-0.7 mm.

Female. Similar to male. Flagellar segments 2.7 times as long as wide. Genitalia as figured.

Measurements: allotype, wing length 1.9 mm.; wing width 0.7 mm. Paratypes, wing length 1.7-2.0 mm.; wing width 0.6-0.7 mm.

Type data: holotype ♂ and allotype ♀, Upper Olaa Forest, Hawaii, August, 1952 (D. E. Hardy). Paratypes, 11 ♂, 7 ♀, same data; 4 ♂, same (W. C. Mitchell). Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, and Hawaiian Sugar Planters' Association, Honolulu; American Museum of Natural History, New York; University of Nebraska, Lincoln; and California Academy of Sciences, San Francisco.

Trichomyia oahuensis new species (Figs. 6-8)

Trichomyia sp. Williams, 1943, Proc. Haw. Ent. Soc., 11:325; Hardy, 1952, *ibid.*, 14:445.

Male. Vestiture golden in color. *Head:* eyes separated by distance equal to 11 facet diameters at level of antenna; labrum shorter than first palpal segment; palpus 3-segmented, first segment with pit on inner margin, tuft of hairs arising from floor of pit, second and third segments about 2/3 size of first, ratio of segments 9:6:7. *Antenna* with 16 segments, about 5/6 times length of wing; sensory filaments 1½ times length of segment bearing them, moderately sinuous, flagellar segments elongate pyriform, 3.1 times as long as greatest width; apical segment very small, round. *Wing* without scales at base; R_{2+3} unbroken, M_{1+2} with base lacking. *Genitalia* as figured.

Measurements: holotype, antenna 1.1 mm.; wing length 1.3 mm.; wing width 0.5 mm. Paratype, antenna, 1.1 mm.; wing length 1.4 mm.; wing width 0.5 mm.

Female. Similar to male. Antenna 2/3 times length of wing; flagellar segments 2.9 times as long as wide; wing narrower. Genitalia as figured.

Measurements: antenna 1.0 mm.; wing length 1.3 mm.; wing width 0.5 mm.

Type data: holotype ♂, Olympus, Oahu, November 1, 1936, 2,000 ft. (F. X. Williams); allotype ♀, same, November 3, 1936, 1,800 ft. Paratypes, 1 ♂, 1 ♀; same data as allotype. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at University of Hawaii, Honolulu.

Trichomyia oahuensis and *hawaiiensis* may be separated by the structure of the male and female genitalia. The aedeagus and lateral appendages of the male genitalia differ considerably in the two species. The spermathecal ducts of *T. hawaiiensis* are very long, while those of *T. oahuensis* are moderately short.

In addition to the above two species of *Trichomyia* there is another form which was also collected at Mt. Olympus, Oahu. This form is close to *T. oahuensis,* but differs in the structure of the male genitalia and wing venation. The form is represented by only a few specimens and it is not possible to make a thorough study of it. Therefore, it is felt inadvisable to name and describe this form at the present time.

Genus **Telmatoscopus** Eaton

Telmatoscopus Eaton, 1904, Ent. Mo. Mag., Ser. 2, 15:58.

Adult characters. Medium to large size; vestiture usually dark colored with some color pattern. Eye bridge present; interocular suture often present; labellum bulbous, flattened apically, bearing number of setae on apical surface, but without teeth. *Antenna* with 15 or 16 segments, longer than width of wing; verticils on flagellum well developed, cupuliform; sensory filaments composed of one pair to numerous anterior branches on each flagellar segment, without posterior branches; flagellar segments nodose, basal portion enlarged into node and apical portion a slender internode; apical segments not conspicuously smaller than preceding segments, though internode of subapical segment may be shortened; apiculis present. *Wing* with apex rounded or acute; R_5 ending in or beyond apex; Rs 4-branched, hence 2 longitudinal veins between bifurcations R_{2+3} and M_{1+2}; Sc not forked. Male genitalia with surstyle bearing multiple tenaculae.

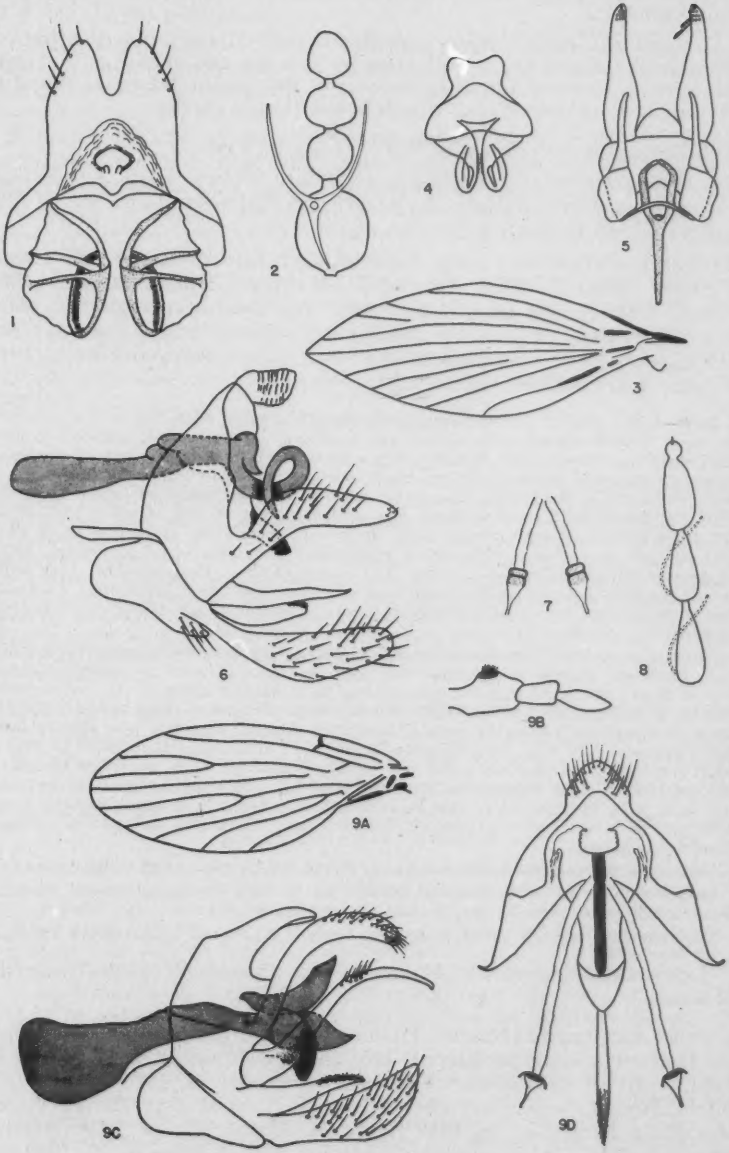
Figures 1-9

Figs. 1-3. **Psychoda insulicola.** Fig. 1. female genitalia, dorsal view. 2. tip of antenna. 3. wing.

Figs. 4-5. **Telmatoscopus albipunctatus.** Fig. 4. female genitalia, dorsal view. 5. male genitalia, dorsal view.

Figs. 6-8. **Trichomyia oahuensis.** Fig. 6. male genitalia, lateral view. 7. female spermatheca. 8. tip of antenna.

Figs. 9a-9d. **Trichomyia hawaiiensis.** Fig. 9a. wing. 9b. male palpus. 9c. male genitalia, lateral view. 9d. female genitalia, dorsal view.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9D

Type of genus: *Pericoma morula* Eaton (by subsequent selection, Tonnoir, 1933:70).

The genus *Telmatoscopus* is predominantly Holarctic in distribution. Twenty-six of the known thirty-six species are found either in North America or Europe. The only element of this psychodid genus found in Hawaii is *T. albipunctatus*, a widely distributed species.

Telmatoscopus albipunctatus (Williston) (Figs. 4, 5)

Psychoda albipunctata Williston, 1893, Ent. News, 4:113; Dyar, 1926, Insec. Ins. Mens., 14:149; del Rosario, 1936, Philip. Jour. Sci., 59:129; Bryan, 1933, Proc. Haw. Ent. Soc., 8:230.

Telmatoscopus albipunctatus, Tonnoir, 1921, Bull. Mus. Nat. Hist., Paris, 27:297; Edwards, 1928, Ent., 61:32; Williams, 1932, Proc. Haw. Ent. Soc., 8:18; Bryan, 1934, *ibid.*, 8:403; Van Zwaluwenberg, 1935, *ibid.*, 9:15; Williams, 1936, *ibid.*, 9:240; 1943, *ibid.*, 11:326; Fullaway and Krauss, 1943, Common Insects of Hawaii, p. 142; Rapp and Rapp, 1946, Jour. N.Y. Ent. Soc., 54:292.

Male. Large species; frons, clypeus, and palpus covered with brown hairs, vertex, antenna, scutum covered with white hairs becoming brown at tips; abdomen clothed with white and brown hairs dorsally, brown hairs ventrally; wings chiefly covered with brown hairs, upper surface with few black hairs on basal half intermixed with brown; white hairs on Sc, R_{2+3} from base to bifurcation, Cu, and apices of veins; white and black patches of hairs at bifurcations R_{2+3} and M_{1+2}; curved row of white patches distad to black band, median patches faint; lower surface with two small patches of white hair at base; legs covered with brown hairs and brown and white tomentum; apices of femora, apices and bases of tibiae, and apices of first tarsal segments with white tomentose annuli, tibiae with scattered white tomentum, tarsal segments 1 to 3 with conspicuous dense brown hair fringe on posterior border, fringe largest on first tarsal segment.

Head: eyes separated by distance equal to about 1 facet diameter; suture extending from inner eye margin to antennal base with median spur near eye margin; labrum shorter than first palpal segment; palpus long, ½ as long as antenna, ratio of segments 8:22:16:19. *Antenna* ½-⅔ times length of wing; sensory filaments composed of 2 anterior branches extending forward to apex of internode; flagellar segments with slender internodes; segment XIV with long apiculis. *Wing* broad, little more than twice as long as wide; membrane translucent, costal cell lightly infuscated; apex acute; Sc ending at level of base of R_{2+3}; bifurcation R_{2+3} distad of M_{1+2} by distance equal to width of cell R_3 at point of bifurcation; vein R_5 ending just at apex. *Legs*, tarsal segment 1 to 4 with pair of stout bristles at lateral posterior apices. *Genitalia* as figured; aedeagus terminating in loop.

Measurements: antenna 2.0-2.6 mm.; wing length 2.6-3.8 mm.; wing width 1.2-1.8 mm.

Female. Similar to male. Antennal verticils not as well developed; sensory filaments composed of single anterior branch. *Genitalia* as figured.

Measurements: antenna 2.3-2.6 mm.; wing length 2.8-4.1 mm.; wing width 1.3-2.0 mm.

Type data: syntypes, 2 ♀, Havana, Cuba, January 27, 1869 (University of Kansas).

Other specimens examined: Honolulu, Oahu, January 1, 1953, at light (D. E. Hardy); same, January 18, 1951 (B. L. Defibaugh); same, March 13, 1931, April 13, 1931 (F. X. Williams); same, May 14, 1929, July 3, 1930 (O. H. Swezey); same, December 2, 1932 (F. X. Williams); Hering Valley, Honolulu, December 30, 1930 (F. X. Williams); Manoa Valley, Oahu, April 16, 1905 (O. H. Swezey); Tantalus, Oahu, February 6, 1930, ex.

kukui tree water (F. X. Williams). Waihee, Maui, June, 1952, at light (D. E. Hardy, M. Tamashiro).

Telmatoscopus albipunctatus is easily recognized due to its large size, color pattern of the vestiture, and the racquet shape of the male aedeagus. There is no other species in the Hawaiian Islands of this size which could be confused with this species.

Williams (1943:326) gives an excellent account of the biology of *T. albipunctatus* and notes that this species breeds in sinks, drains, wet mud, water in tree holes, rain barrels, shallow little pools partly filled with dead leaves and debris, and rinds of kukui tree fruit. Dyar (1926:149) reported that the larvae of *T. albipunctatus* have been found with those of the mosquitoes *Culex quinquefasciatus* and *Aedes aegypti*. Efflatoun (1921, Bull. Soc. ent. d'Egypte, 6:22) gave an account of large numbers of the immature stages of *T. albipunctatus* (= *T. meridionalis* Eaton) living in a water-tank used for macerating bones. These divergent types of larval habitats would indicate a wide range of tolerances on the part of *T. albipunctatus* and help explain the wide occurrence of this species.

Genus **Psychoda** Latreille

Psychoda Latreille, 1796, Precis caract. gen. ins., p. 152.

Adult characters. Small to medium size; vestiture usually uniformly yellowish in color. Eye bridge present; interocular suture present or absent; labellum flattened with number of teeth on apical margin and several spines near lateral margin or bulbous without teeth. *Antenna* with 14 to 16 segments, longer than width of wing; verticils on flagellum well developed, cupuliform; sensory filaments almost always Y-shaped, sometimes with 3 anterior branches; flagellar segments nodose, basal portion enlarged into node and apical portion a slender internode; flagellar segment XII and following segments, if present, reduced in size, about ½ size of preceding segments; apiculis absent. *Wing* with apex acute; R_5 ending in apex; Rs 4-branched, hence 2 longitudinal veins between bifurcations R_{2+3} and M_{1+2}; Sc not forked. Male genitalia usually with surstyle bearing single tenaculum.

Type of genus: *Tipula phalaenoides* Linnaeus (by monotypy).

The genus *Psychoda* contains most of the species of psychodids found in the Hawaiian Islands. Other members of the genus are distributed throughout the world with a goodly number of species in all the zoogeographical regions.

Key to Species of Psychoda

1. Bases of veins R_5 and M_3 present or only lacking at bifurcation; hairs originating only on wing veins, not on membrane; labellum flattened, bearing row of blunt teeth on apical margin 2

   Basal third of veins R_5 and M_3 lacking; hairs originating on membrane as well as on veins; labellum bulbous, without blunt teeth ..... **insulicola** n.sp.

2. Tips of longitudinal veins with brown spots (may be faint in teneral specimens); flagellar segments XIII and XIV broadly fused together 3

   Tips of longitudinal veins without markings; terminal flagellar segments clearly separated 4

3. Apical portion of female subgenital plate V-shaped; lower process of male aedeagus as large as apical half of main shaft, extending to or beyond apex of main shaft (Fig. 15) ..... **alternata** Say

   Apical portion of female subgenital plate cigar-shaped, not bilobed; lower process of male aedeagus smaller than apical half of main shaft, not extending to apex of shaft (Fig. 11) ..... **pseudalternata** Williams

4. Antenna with 14 or 16 segments; bases of R_3 and M_3 present 5
   Antenna with 15 segments; bases of R_3 and M_3 lacking ..... **wirthi** n.sp.
5. Antenna with 14 segments 6
   Antenna with 16 segments 8
6. R_{2+3} subequal to length of R_3; female subgenital plate with sides of apical half convergent 7
   R_{2+3} noticeably longer than R_3 (6:5); female subgenital plate with sides of apical half parallel ..... **inornata** Grimshaw
7. Male with wing broad, 2 times as long as broad; female subgenital plate terminating as pair of small, slender lobes ..... **hardyi** n.sp.
   Male wing moderately slender, 2½ times as long as broad; female subgenital plate terminating as pair of broadly rounded lobes ..... **lucia** n.sp.
8. Male with surstyle short and stocky, little longer than ninth tergite; female with apical portion of subgenital plate with convergent sides, sides not suddenly narrowing 9
   Male with surstyle relatively long and slender, nearly twice as long as ninth tergite; female with apical portion of subgenital plate with parallel or divergent sides, suddenly narrowing near base or center 10
9. Teeth of labellum very short, not as long as wide; male with R_{2+3} considerably shorter than R_2 (5:8); female subgenital plate nearly as long as wide ..... **salicornia** n.sp.
   Teeth of labellum normal, considerably longer than wide; male with R_{2+3} subequal to length of R_3; female subgenital plate twice as wide as long ..... **williamsi** n.sp.
10. Male aedeagus with basal portion anterior to base of style (coxite) lightly sclerotized, apical recurved hook moderately long and very slender; female subgenital plate with large, lateral expansions at base extending forward almost to apex of plate ..... **harrisi** Satchell
    Male aedeagus with basal portion normally sclerotized, apical hook short and broad; female subgenital plate without large lateral expansions at base ..... **uncinula** n.sp.

Psychoda insulicola new species (Figs. 1-3)

Female. *Head:* eyes separated by distance equal to less than ½ facet diameter; interocular suture present, with median spur projecting posteriorly; labrum longer than first palpal segment; labellum bulbous, bearing number of setae and spines, but without teeth; ratio of palpal segments 10:14:16:18. *Antenna* with 16 segments, nearly ½ times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; terminal 3 segments reduced in size, clearly separated from each other. *Wing* moderately narrow, 3 times as long as wide; hairs arising from veins and membrane; basal half of R_3 and base of M_3 lacking. *Genitalia* as figured; subgenital plate deeply cleft at apex.

Measurements: holotype, antenna 0.9 mm.; wing length 2.1 mm.; wing width 0.7 mm. Paratypes, wing length 1.9-2.2 mm.; wing width 0.7-0.8 mm..

Male. Unknown.

Type data: holotype ♀, Honolulu, Oahu, June, 1952, light trap (D. E. Hardy). Paratypes, 1 ♀, same data; 6 ♀, same, January 19, 1951 (B. L. Defibaugh); 1 ♀, same, January 24, 1951; 1 ♀, Waimanalo, Oahu, January 31, 1951 (D. E. Hardy); 1 ♀, Manoa Valley, Oahu, March 17, 1949, at light (G. Howe). All types whole mounts on slides. Holotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; California Academy of Sciences, San Francisco; and University of Nebraska, Lincoln.

The characters of *P. insulicola* which make this species distinctive are the bulbous labellum, the absence of the bases of veins R_3 and M_2 and the deeply cleft female subgenital plate.

Psychoda insulicola is noteworthy due to the bulbous labellum and the hairs on the wing membrane as well as the veins. Tonnoir (1922) proposed the subgenus *Trichopsychoda* to include the species of the genus *Psychoda* with the hairy membrane. At a later date (1940, Trans. Soc. Brit. Ent., 7:61) he indicated that he considered the group of generic status. I prefer to include *P. insulicola* in the genus *Psychoda* at this time, although it is divergent from other members of the genus that occur in the Hawaiian Islands and undoubtedly represents at least a separate subgenus.

Psychoda alternata Say (figs. 13-16)

Psychoda alternata Say, 1824, Narrative expedition source St. Peter's River, 2:358; Grimshaw, 1901, Fauna Haw., 3:6; Swezey, 1907, Proc. Haw. Ent. Soc., 1:116; Tonnoir, 1922, Ann. Soc. Ent. Belg., 62:72; Illingworth, 1927, Proc. Haw. Ent. Soc., 6:394; Swezey & Bryan, 1929, *ibid.*, 7:301; Swezey and Williams, 1932, *ibid.*, 8:187; Bryan, 1934, *ibid.*, 8:403, 445; del Rosario, 1936, Philip. Jour. Sci., 59:93; Williams, 1938, Proc. Haw. Ent. Soc., 10:112; 1943, *ibid.*, 11:334; Rapp and Rapp, 1946, Jour. N. Y. Ent. Soc., 54:291. (For complete synonymy see Tonnoir, 1934 and del Rosario, 1936.)

Male. Vestiture white to pale yellow; wing vestiture very light brown, with indistinct white band at base and at middle, apices of longitudinal veins with brown spots ringed by white areas. (Teneral or denuded specimens show only brown spots at apices of veins.) *Head:* eyes separated by distance equal to 1 to 3 facet diameters; interocular suture usually absent; labrum longer than first palpal segment; labellum flattened, bearing 4 (sometimes 5) long and 1 short teeth and 3 spines; third palpal segment moderately expanded, larger in diameter than other segments, ratio of segments 9:10:9:13. *Antenna* with 15 segments, 5/9 times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches, branches short; terminal two segments reduced in size, flagellar segments XI and XII fused together, XII smaller than XI; XIII free, very small. *Wing* 2½ times as long as wide; bifurcation R_{2+3} at middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 2 to 3 times width of cell R_5 at level of bifurcation; ratio of $R_{2+3}:R_2:R_5 = 10:10:15$. *Genitalia* as figured, surstyle long and slender, nearly twice as long as 9th tergite.

Measurements: antenna 1.0-1.2 mm.; wing length 1.2-2.3 mm.; wing width 0.5-0.9 mm.

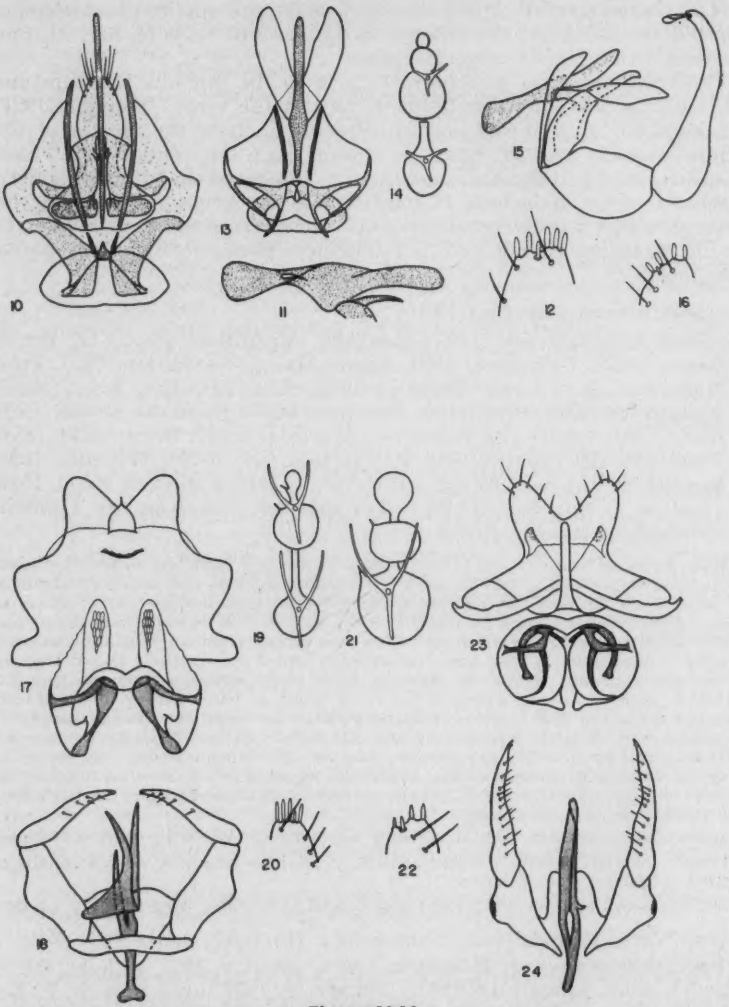
Female. Similar to male. Antenna shorter, ⅕-½ times length of wing. Genitalia as figured, subgenital plate V-shaped.

Measurements: antenna 0.8-1.2 mm.; wing length 1.4-3.0 mm.; wing width 0.7-1.3 mm.

Type data: Philadelphia, Pennsylvania. (Probably destroyed.)

Specimens examined: Honolulu, Oahu, January, 1953, at light (D. E. Hardy); same, January 18, 1951, January 19, 1951, light trap (B. L. Defibaugh); same, June 16, 1936 (F. X. Williams); Waialae, Oahu, December 10, 1946, chicken manure (L. Kartman); Waianae Mts., Oahu (low), 1945, light trap (M. Y. Webb). Waihee, Maui, June, 1952, light trap. Hilo, Hawaii, November, 1945, light trap (W. W. Wirth); Pahala, Hawaii, March 9, 1907.

Psychoda alternata is a common and abundant species. Specimens were very numerous in all light trap collections from Honolulu. It also is frequently taken in large numbers by light traps in the United States.



Figures 10-16

Figs. 10-12. **Psychoda pseudalternata.** Fig. 10. female genitalia, dorsal view. 11. aedeagus of male genitalia, lateral view. 12. labellum.

Figs. 13-16. **P. alternata.** Fig. 13. female genitalia, dorsal view. 14. tip of antenna. 15. male genitalia, lateral view. 16. labellum.

Figures 17-24

Figs. 17-20. **Psychoda inornata.** Fig. 17. female genitalia, dorsal view. 18. male genitalia, dorsal view. 19. tip of antenna. 20. labellum of female.

Figs. 21-24. **P. wirthi.** Fig. 21. tip of antenna. 22. labellum. 23. female genitalia, dorsal view. 24. male genitalia, dorsal view.

In North America there are several species in the *alternata* complex. Tonnoir (1922:73) identified the name *P. alternata* with that species possessing the V-shaped female subgenital plate, which concept I accept. Del Rosario (1936) illustrated a species of the *alternata* complex with a U-shaped subgenital plate, which has been named *lativentris* Berdén.

Psychoda pseudalternata Williams (Figs. 10-12)

Psychoda pseudalternata Bryan, 1940, Proc. Haw. Ent. Soc., 10:370 (*nomen nudum*).

"Psychoda pseudalternata Tonnoir (unpublished)," Williams, 1943, Proc. Haw. Ent. Soc., 11:336 (*nomen nudum*).

Psychoda pseudalternata Williams, 1946, Proc. Haw. Ent. Soc., 12:637; Rapp and Rapp, 1946, Jour. N. Y. Ent. Soc., 54:292; Hardy, 1952, Proc. Haw. Ent. Soc., 15:445.

Male. Vestiture white to pale yellow; wing vestiture very light brown, with indistinct white band at base and at middle, apices of longitudinal veins with brown spots ringed by white areas (teneral or denuded specimens show only brown spots at apices of veins). *Head:* eyes separated by distance equal to 2 to 3 facet diameters; interocular suture usually absent; labrum longer than first palpal segment; labellum flattened, bearing 5 long and 1 short teeth and 3 spines; second and third palpal segments expanded, larger in diameter than other segments, ratio of segments 10:10:10:14. *Antenna* with 15 segments, 2/5 times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches, branches short; terminal two segments reduced in size; flagellar segments XI and XII fused together; XII smaller than XI; XIII free, very small. *Wing* about 2½ times as long as wide; bifurcation R_{2+3} near middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 1 to 2 times width of cell R_2 at level of bifurcation, ratio of $R_{2+3}:R_2:R_3 = 10:9:15$. *Genitalia* as figured; surstyle long and slender, nearly twice as long as ninth tergite.

Measurements: antenna 0.7-0.8 mm.; wing length 1.6-1.7 mm.; wing width 0.7-0.8 mm.

Female. Similar to male. Genitalia as figured; apical portion of subgenital plate rod-shaped, arising from basal band.

Measurements: antenna 0.7-1.0 mm.; wing length 1.7-2.4 mm.; wing width 0.7-1.1 mm.

Type data: ♂, Canberra, A. C. T., Australia (Bishop Museum).

Specimens examined: Honolulu, Oahu, January 19, 1951, light trap (B. L. Defibaugh); same, April 18, 1935 (F. X. Williams); Hering Valley, Honolulu, November 8, 1933 (F. X. Williams); Lanikai, Oahu, December 17, 1945, light trap (W. W. Wirth); Mt. Kaala, Oahu, November 6, 1945, 4,000 ft. (W. W. Wirth).

Psychoda pseudalternata and *P. alternata* are closely allied species and are readily distinguished from other Hawaiian species by the brown spots at the tips of the longitudinal wing veins and the fifteen-segmented antenna. The rod-like structure of the terminal part of the female subgenital plate easily distinguishes the female of *P. pseudalternata* from the female of *P. alternata* with its V-shaped subgenital plate. The males of these two species are less readily distinguished. Apparently, the only important difference lies in the form of the aedeagus. In *P. pseudalternata* the lower process of the aedeagus is much smaller in diameter than the upper shaft, is sharply pointed, and terminates one-third the length of the main shaft from its apex. The lower shaft of *P. alternata* is nearly equal in diameter to the main shaft, is rounded apically, and terminates on the same level as the main shaft.

The status of the name *Psychoda pseudalternata* is reviewed by Hardy (1952:446), who pointed out that the name has appeared in the literature twice (Bryan, 1940:370; Williams, 1943:336) as a *nomen nudum* with the authorship being incorrectly accredited to Tonnoir. Tonnoir never published the name. In 1946 Williams validated the name by a description; hence, authorship should be accredited to Williams and priority is effective as of May, 1946.

This is one of the more abundant species of Hawaii, specimens being numerous in nearly all light trap collections from Honolulu which I have examined. *Psychoda pseudalternata* and *P. alternata* constituted the bulk of such collections.

The fact that *P. pseudalternata* and *P. alternata* share so many characters in common makes it natural to assume that these two species arose from a common ancestor. During a part of their evolutionary history, these two species must have been allopatric in distribution. At the present time the two species are sympatrically distributed at least in Hawaii, both species having been taken in the same collections from Honolulu. Outside of Hawaii *P. pseudalternata* is known only from Australia, while *P. alternata* is almost world-wide in distribution. *Psychoda pseudalternata* is probably the native species and *P. alternata* the introduced species due to the wider distribution of the latter.

Psychoda wirthi new species (Figs. 21-24)

Male. *Head:* eyes separated by distance equal to 1 facet diameter; interocular suture absent; labrum longer than first palpal segment; labellum flattened, bearing 4 long teeth and 2 spines; palpal segments subequal in diameter, ratio of segments 10:10:10:13. *Antenna* with 15 segments, ⅔ length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; apical two segments reduced in size, about ½ size of preceding segments. *Wing* about 2⅓ times as long as wide; bifurcation little distad of middle of wing; bases of R_s and M_s lacking. *Genitalia* as figured; aedeagus rod-like; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype, antenna 0.9 mm.; wing length 1.3 mm.; wing width 0.6 mm.

Female. Similar to male. Interocular suture present (sometimes absent). Antenna ½ as long as wing. Genitalia as figured; subgenital plate with divergent sides, apical indentation V-shaped; genital digit very long, originating at base of plate.

Measurements: allotype, antenna 0.9 mm.; wing length 1.8 mm.; wing width 0.7 mm.

Type data: holotype ♂, allotype ♀, Honolulu, Oahu, June, 1952, light trap (D. E. Hardy). Paratypes, 4 ♀, same data, 1 ♂, same, January, 1953; 1 ♀, same, January 19, 1951 (B. L. Defibaugh); 1 ♂, same, January 24, 1951; 2 ♂, 2 ♀, same, October, 1952, light trap (D. E. Hardy). 1 ♀, Waihee, Maui, June, 1952, at light (D. E. Hardy and M. Tamashiro); 2 ♀, same, light trap. 1 ♀, Hilo, Hawaii, November, 1945, light trap (W. W. Wirth). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association, Honolulu; University of Nebraska, Lincoln; and California Academy of Sciences, San Francisco.

Psychoda wirthi is separable from other Hawaiian psychodids on the basis of the fifteen-segmented antenna, the divergent-sided female subgenital plate, and the absence of the bases of veins R_s and M_2. Also,

this is the only species in which the genital digit of the female originates at the base of the subgenital plate, rather than near the center.

It is with pleasure that I take the opportunity to name this species in honor of my friend, Dr. Willis W. Wirth of the U. S. Department of Agriculture.

Psychoda inornata Grimshaw (Figs. 17-20)

Psychoda inornata Grimshaw, 1901, Fauna Haw., 3:6; Swezey, 1907, Proc. Haw. Ent. Soc., 1:116; Bryan, 1934, *ibid.*, 8:403; Rapp and Rapp, 1946, Jour. N. Y. Ent. Soc., 54:291; Hardy, 1952, Proc. Haw. Ent. Soc., 14:445.

Psychoda severini Tonnoir, 1922, Ann. Soc. ent. Belg., 62:78.
New synonymy.

Male. Vestiture dull golden. *Head:* eyes separated by distance equal to 1 facet diameter; interocular suture absent or faint; labrum longer than first palpal segment; labellum with 1 short and 3 long teeth and 2 spines; palpal segments approximately equal in diameter, ratio of segments 10:10:10:14. *Antenna* with 14 segments, ¾ as long as wing; sensory filaments composed of 2 anterior and 1 posterior branches; apical segments reduced in size, internode bearing tubercle near base of node. *Wing* 2½ times as long as wide; bifurcation R_{2+3} little beyond middle of wing; bifurcation M_{1+2} mesad of bifurcation R_{2+3} by distance equal to 5 times width of cell R_3 at level of bifurcation; ratio of R_{2+3}:R_2:R_3 = 12:10:14. *Genitalia* as figured; surstyle long and slender, twice as long as ninth tergite.

Measurements: antenna 0.9-1.5 mm.; wing length 1.5-2.2 mm.; wing width 0.5-0.9 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters, interocular suture often present; labellum with 1 short and 4 long teeth and 4 spines; antenna little more than ½ as long as wing; ratio of R_{2+3}:R_2:R_3 = 10:6:10.

Measurements: antenna 0.8-1.5 mm.; wing length 1.4-2.8 mm.; wing width 0.5-1.0 mm.

Type data: ♀, Kona, Hawaii, August, 1892, 4000 ft. [British Museum (Natural History)].

Specimens examined: 1 ♀, Honolulu, Oahu, April, 1951, bait trap (D. E. Hardy); 3 ♀, Paliku, Haleakala Crater, Maui, June, 1952 (M. Tamashiro); 2 ♀, Makawao, Maui, June, 1952, at light (D. E. Hardy and M. Tamashiro).

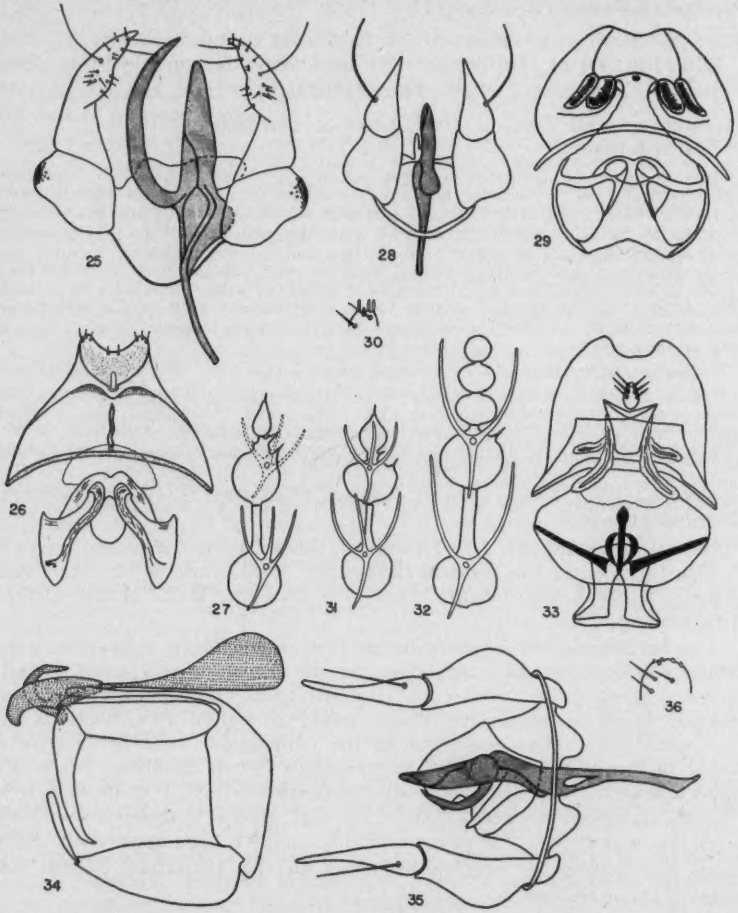
The behavior of *P. inornata* in the Hawaiian Islands appears to differ from its actions in North America. I have examined specimens from 17 states ranging from New York to California, British Columbia, and Alaska. Many of these records were based on light trap collections and specimens were often numerous in the collections. In other words, *P. inornata* is a common, abundant species in North America. Yet of the approximately 1000 specimens of psychodids which I examined from Hawaii, only 6 specimens of *P. inornata* were present and only two of these were taken at light. The point I wish to make is that apparently differences are present between populations in the Hawaiian Islands and those of the mainland.

Dr. Paul Freeman examined the type of *inornata* and on the basis of his examination of the wing and antenna it became evident that *inornata* and *severini* were possibly synonymous. Dr. Geoffrey Satchell later confirmed this synonymy by a critical examination of the type after it had been boiled and cleared.

Psychoda hardyi new species (Figs. 25-27).

Psychoda sp. 2 Williams, 1943, Proc. Haw. Ent. Soc., 11:337.

Male. Vestiture chiefly dark gray, vestiture of antenna and legs dark brown. *Head:* eyes separated by distance equal to 1 facet diameter; interocular suture absent; labrum longer than first palpal segment; labellum flattened, bearing 3 long and 1 short teeth and 2 spines; first palpal segment with small, rounded tubercle on medial, apical margin, terminal segment more slender than other segments, ratio of segments 10:10:10:14.



Figures 25-36

Figs. 25-27. **Psychoda hardyi.** Fig. 25. male genitalia, dorsal view. 26. female genitalia, dorsal view. 27. tip of male antenna.

Figs. 28-31. **P. lucia.** Fig. 28. male genitalia, dorsal view. 29. female genitalia, dorsal view. 30. labellum. 31. tip of male antenna.

Figs. 32-36. **P. salicornia.** Fig. 32. tip of antenna. 33. female genitalia, dorsal view. 34. male genitalia, lateral view. 35. male genitalia, dorsal view. 36. labellum.

Antenna with 14 segments, ⅔ times length of wing; sensory filaments composed of 3 anterior and 1 posterior branches; apical segment reduced in size; internode with long, spine-bearing tubercle and short, spine-bearing tubercle. *Wing* broad, little more than twice as long as wide; bifurcation R_{2+3} little before middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to twice width of cell R_5 at level of bifurcation; ratio of R_{2+3}:R_2:R_5 = 10:10:13. *Genitalia* as figured; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype, antenna 1.1 mm.; wing length 1.5 mm.; wing width 0.8 mm.

Female. Similar to male. Vestiture of antenna and legs brown. Eyes separated by distance equal to nearly 2 facet diameters. Antenna little more than ½ as long as wing. Wing 2½ times as long as wide. Genitalia as figured; subgenital plate with deep apical concavity.

Measurements: allotype, antenna 1.1 mm.; wing length 2.0 mm.; wing width 0.9 mm. Paratypes, wing length 1.5-2.0 mm.; wing width 0.6-0.9 mm.

Type data: holotype ♂, Honolulu, Oahu, January 24, 1951, light trap (B. L. Defibaugh); allotype ♀, Waimanalo, Oahu, January 31, 1951, ex rotten cucumber (T. Nishida). Paratypes, 1 ♂, same data as holotype; 6 ♂, same data as allotype; 1 ♀, Honolulu, January 18, 1951, light trap (B. L. Defibaugh); 1 ♂, 6 ♀, same, January 19, 1951; 4 ♂, 2 ♀, same, June, 1952, light trap (D. E. Hardy). 1 ♀, Hilo, Hawaii, November, 1945, light trap (W. W. Wirth). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; University of Nebraska, Lincoln; and California Academy of Sciences, San Francisco.

Other specimens examined: Honolulu, Oahu, ex rotten vegetation (D. E. Hardy); Waimanalo, April, 1952, ex rotten tomatoes (T. Nishida). Kukuiala Valley, Oahu, September 16, 1933, ex rotten *Alactryon* fruit (O. H. Swezey) (det. *Psychoda inornata* Grim. by Bryan); Kipapa, Oahu, August, 1945, (W. W. Wirth); Waihee, Maui, June, 1952, at light (D. E. Hardy & M. Tamashiro).

Psychoda hardyi is easily recognized by the three anterior branches of the sensory filaments, the broad wings of the male and the female subgenital plate in combination with the fourteen-segmented antennae. The subgenital plate tapers from its base to apex and terminates in a pair of small lobes separated by a marked concavity. The characters of the male genitalia are distinctive, but the differences between this and other species are more subtle.

Williams' drawings of *Psychoda* sp. 2 (1943:338) agree well with *P. hardyi* and undoubtedly the two belong to the same species. The illustration of the male genitalia of *Psychoda* sp. 2 doesn't show all of the aedeagus, but the illustrated parts more closely resemble *P. hardyi* than any other known Hawaiian species.

I take pleasure in naming this species in honor of my friend, Dr. D. Elmo Hardy, who furnished many of the specimens studied for this revision.

Psychoda lucia new species (Figs. 28-31)

Male. *Head:* eyes separated by distance equal to less than ½ facet diameter; interocular suture absent; labrum longer than first palpal segment; flagellum with 3 long and 1 short teeth and 2 spines; third palpal segment expanded, larger in diameter than other segments, ratio of segments 10:10:10:14. *Antenna* with 14 segments, about ⅔ as

long as wing; sensory filaments composed of 3 anterior and 1 posterior branches; apical segment reduced in size, internode expanded on one side at base. *Wing* nearly 2½ times as long as wide; bifurcation R_{2+3} little mesad of middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to twice width of cell R_3 at level of bifurcation; ratio of R_{2+3}:R_3:R_2 = 10:9:13. *Genitalia* as figured; dististyle enlarged basally, bearing 1 very long hair ⅓ distance from base; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype, antenna 0.9 mm.; wing length 1.3 mm.; wing width 0.5 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters; antenna about ⅔ times length of wing. Genitalia as figured; subgenital plate broad with marked apical concavity; rosette-like structure internally at base of each apical lobe.

Measurements: allotype, antenna 0.8 mm.; wing length 1.3 mm. Paratypes, wing length 1.2-1.4 mm.; wing width 0.4-0.5 mm.

Type data: holotype ♂, and allotype ♀, Gastries, St. Lucia, West Indies, September 10 to 22, 1919 (J. C. Bradley). Paratypes, 6 ♀, same data; 1 ♂, 1 ♀, Morrison Field, West Palm Beach, Florida, September 20, 1942 (D. E. Hardy); 1 ♀, same, September 22, 1942; 1 ♀, same, October 2, 1942; 1 ♂, 1 ♀, same, December 5, 1942; 2 ♂, same, January 15, 1943; 1 ♀, Miami, Florida, October, 1943 (W. W. Wirth). All types whole mounts on slides. Holotype, allotype and paratypes to be returned to Cornell University, Ithaca, New York. Paratypes to be deposited at U. S. National Museum, Washington, D. C.; American Museum of Natural History, N. Y.; University of Nebraska, Lincoln; California Academy of Sciences, San Francisco; and Bishop Museum, Honolulu.

Other specimens examined: Honolulu, Oahu, January 2, 1951, January, 1953, at light (D. E. Hardy); same, January 2, 1951, January 18, 1951, January 19, 1951, light trap (B. L. Defibaugh).

Psychoda lucia is separable from other Hawaiian species by the fourteen-segmented antenna, the three anterior branches of the sensory filaments, the broad, bilobed subgenital plate of the female, and the structure of the male genitalia, especially the short, thick, and laterally expanded basistyle.

The apparent discontinuous distribution of *P. lucia*, being known only from the West Indies, Florida, and Hawaii, may raise the question as to whether we are dealing with but a single species. This point was in the author's mind when he was studying the species. No significant differences were discerned between the specimens from the West Indies and Florida and those from Hawaii. *Telmatoscopus albipunctatus* has a similar distribution, but also has been reported from various points in the southern United States, and other tropical and subtropical regions of the world. However, *T. albipunctatus* is a large, conspicuous psychodid, while *P. lucia* is a small, unicolorous species. It is conceivable that *P. lucia* may have a distribution similar to that of *T. albipunctatus* but has been overlooked or simply disregarded because of its small size and unobtrusiveness, whereas *T. albipunctatus* would be more readily collected due to its attractive appearance.

Psychoda salicornia new species (Figs. 32-36)

Male. Vestiture brown; wing with dark brown scales on lower surface sparsely scattered over basal half; costa with long, dense brush of hairs arising from basal angle and lying flat on lower surface. *Head:* eyes separated by distance equal to 1½ facet diameters; interocular suture present; frons with faint suture from anterior median eye margin to antennal base, clear spot adjacent and posterior to antennal base, disc

covered with hair, median band extending posteriorly almost to interocular suture; labrum longer than first palpal segment; labellum with 5 very short teeth and 3 spines; palpal segments of nearly equal diameter, ratio of segments 9:14:15:18. *Antenna* with 16 segments, approximately ¾ times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; flagellar segment I with clavate node 1⅓ times length of internode; nodes of segments II to VIII similar, but progressively becoming globular, remaining nodes globular; flagellar segment XI with short internode; XII, XIII, and XIV clearly separated from each other; XII and XIII equal in size; XIV somewhat smaller than two preceding segments. *Thorax:* anepisternum of mesothorax a large, ovoid plate, outer surface covered with setae and few, scattered hairs on posterior third, internal surface with small black, rod-like structures. *Wing* 2⅓ times as long as wide; costa thickened, with strong angle immediately beyond distal node; bifurcation R_{2+3} mesad of middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to twice width of cell R_3 at level of bifurcation; ratio of R_{2+3}:R_2:R_3 = 10:16:22. *Genitalia* as figured; surstyle short, enlarged basally; little longer than ninth tergite; aedeagus with basal fan-shaped enlargement laterally flattened, terminating as stout, downward curving hook, flanked by slender, acute, upward curving hook.

Measurements: holotype, antenna 1.6 mm.; wing length 2.1 mm.; wing width 0.9 mm. Paratypes, antenna 1.5 mm.; wing length 1.9-2.2 mm.; wing width 0.8-1.0 mm.

Female. Similar to male. Antenna shorter, nearly ½ as long as wing; anepisternum of mesothorax normal; wing narrower, 2½ times as long as wide, without scales or costal brush of hairs; ratio of R_{2+3}:R_2:R_3 = 10:10:16. Genitalia as figured.

Measurements: allotype, antenna 1.3 mm.; wing length 2.3 mm.; wing width 0.9 mm. Paratypes, antenna 1.4-1.5 mm.; wing length 2.0-2.6 mm.; wing width 0.8-1.1 mm.

Type data: holotype ♂, and allotype ♀, Alviso, Santa Clara Co., California, September 9, 1949, salt marsh (L. W. Quate). Paratypes, 4 ♂, 3 ♀, same data; 5 ♂, 6 ♀, Milpitas, Santa Clara Co., California, October 21, 1950, light trap (W. Graef); 1 ♀, Alum Rock Park, Santa Clara Co., California, February 23, 1950 (L. W. Quate); 12 ♂, 2 ♀, Alameda, Alameda Co., California, November 4, 1949 (L. W. Quate); 4 ♂, 3 ♀, Inverness, Marin Co., California, September 25, 1950 (L. W. Quate); 1 ♀, Sausalito, Marin Co., California, October 24, 1941 (C. T. Dodds). All types whole mounts on slides. Holotype and allotype to be deposited at the California Academy of Sciences, San Francisco. Paratypes to be deposited at the U. S. National Museum, Washington, D. C.; American Museum of Natural History, New York; University of Nebraska, Lincoln; California Insect Survey, Berkeley; and Bishop Museum, Honolulu.

Other specimens examined: Honolulu, Oahu, February, 1946, June, 1945, light trap (W. W. Wirth).

Psychoda salicornia resembles *Psychoda williamsi* and *P. cinerea* in the general facies of the male genitalia and the sixteen-segmented antenna with the three terminal segments separated. However, *P. salicornia* is differentiated from these species by the very short teeth on the labellum, the costal brush of hairs and the scales on the lower surface of the male wing, and the characters of the male and female genitalia as illustrated.

In California the pickle weed, *Salicornia ambigua,* typical of the salt marshes along the coast, characterizes the habitat in which this psychodid is found. The adults are found abundantly on the stems and branches of the pickle weed. When disturbed they quickly seek shelter in the lowermost parts of the plants. Although searches were made for this species in the spring and early summer, specimens were collected only in the fall and winter months. As the only Hawaiian record is based on light trap collections, it is unknown whether *P. salicornia* exists under the same ecological condition in Hawaii as it does on the mainland.

Psychoda williamsi new species (Figs. 44-45)

Psychoda sp. 1 Williams, 1943, Proc. Haw. Ent. Soc., 11:336

Male. Vestiture brown. *Head:* eyes separated by distance equal to 1 facet diameter, interocular suture absent; labrum little longer than first palpal segment; labellum flattened, bearing 4 long and 1 short teeth and 4 spines; palpal segments similar in diameter, ratio of segments 10:14:16:18. *Antenna* with 16 segments, about ⅔ length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; terminal 3 segments reduced in size, clearly separated from each other. *Wing* 2½ times as long as broad; dense tuft of brown hairs sub-basally on costa; bifurcation R_{2+3} at middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 3 times width of cell R_5 at level of bifurcation; ratio of R_{2+3}:R_2:R_3 = 10:10:13. *Genitalia* as figured; surstyle short and stocky.

Measurements: holotype, antenna 1.3 mm.; wing length 1.9 mm.; wing width 0.8 mm. Paratypes, antenna 1.1-1.3 mm.; wing length 1.5-1.9 mm.; wing width 0.6-0.8 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters. Antenna 5/9 times length of wing. Genitalia as figured; subgenital plate broad, apex with weak concavity.

Measurements: allotype, antenna 1.1 mm.; wing length 1.9 mm.; wing width 0.8 mm. Paratypes, antenna 0.9-1.2 mm.; wing length 1.6-2.1 mm.; wing width 0.7-0.8 mm.

Type data: holotype ♂, Palikea, Oahu, March 14, 1937, wet scum on tank (F. X. Williams); allotype ♀, same, March, 4, 1936. Paratypes, 1 ♀, same data as holotype; 1 ♂, same data as allotype; 1 ♂, 2 ♀, same, February 26, 1937; 1 ♂, Honolulu, January 4, 1940, *Melaleuca* stump sap (F. X. Williams); 3 ♀, Honolulu, January 18, 1951, light trap (B. L. Defibaugh); 1 ♂, 2 ♀, same, January 19, 1951; 1 ♀, same, June, 1952 (D. E. Hardy); 2 ♂, 1 ♀, Mt. Olympus, Oahu, October 26, 1936. decaying *Freycinetia* (F. X. Williams); 1 ♀, Mt. Olympus, December 1, 1933, wet uluhi fern trash (F. X. Williams); 2 ♂, 2 ♀, Lanikai, Oahu, December 17, 1945, light trap (W. W. Wirth); 1 ♀, behind Tantalus, Oahu, January 23, 1937, 1700 ft. (F. X. Williams); 1 ♂, Manoa, Oahu, August 2, 1936, *Freycinetia* interleaf bases (F. X. Williams); 1 ♂, Palolo, Oahu, January 29, 1922 (J. F. Illingworth). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; University of Nebraska, Lincoln; California Academy of Sciences, San Francisco.

Other specimens examined: Hilo, Hawaii, November, 1945, light trap (W. W. Wirth). Waihee, Maui, June, 1952, light trap.

Psychoda williamsi is separable from other Hawaiian species by the short, thickened surstyle of the male genitalia, the relatively broad subgenital plate of the female, and the sixteen-segmented antenna. This species is very similar to *Psychoda cinerea* Banks, a common species in the United States. The chief difference between these two species lies in the structure of the male aedeagus. The aedeagus of *P. cinerea* is broad

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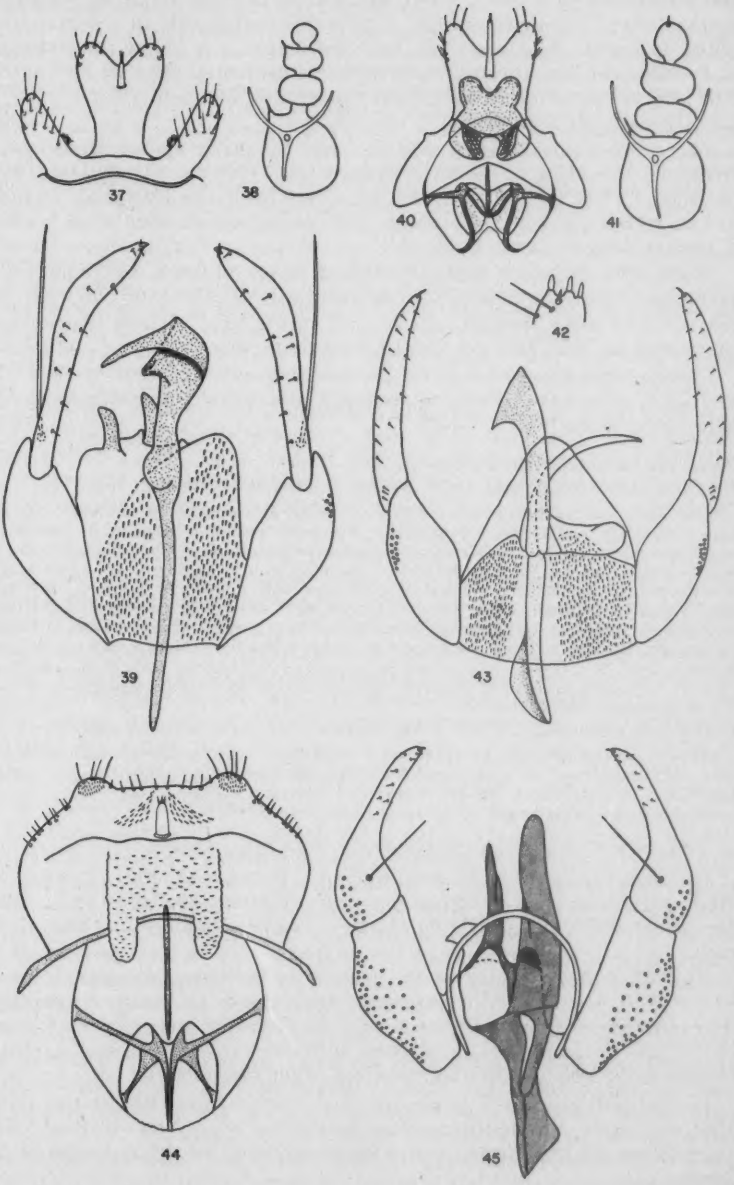
Figures 37-45

Figs. 37-39. **Psychoda harrisi.** Fig. 37. female genitalia, dorsal view. 38. tip of antenna. 39. male genitalia, dorsal view.

Figs. 40-43. **P. uncinula.** Fig. 40. female genitalia, dorsal view. 41. tip of antenna. 42. labellum. 43. male genitalia, dorsal view.

Figs. 44-45. **P. williamsi.** Fig. 44. female genitalia, dorsal view. 45. male genitalia, dorsal view.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and terminates in a sharp point, while that of *P. williamsi* is relatively narrow and is rounded apically. This is observable only in a dorsal view of the aedeagus. Also, there is a rounded, setose lobe below the aedeagus of *P. williamsi,* but this lobe is broadly truncate and bare in *P. cinerea.* The apical concavity of the female subgenital plate of *P. williamsi* is somewhat deeper than that of *P. cinerea.*

The close similarity of *P. williamsi* and *P. cinerea* has resulted in the erroneous recording of the latter species from Hawaii. Hardy (1952:445) recorded *P. cinerea* (Quate's identification) from the Hawaiian Islands, but in reality the reported species is *P. williamsi.* Insofar as is known, *P. cinerea* does not occur in Hawaii.

Psychoda williamsi is undoubtedly the same species as *Psychoda* sp. 1 Williams (1943:336), of which Williams illustrates the wing, surstyle and coxites. The short, swollen surstyle and rather long, slender dististyle as illustrated by Williams are identical to those structures of *P. williamsi.*

I take pleasure in naming this psychodid species in honor of Dr. F. X. Williams, who was the first to seriously investigate the biologies of the Hawaiian Psychodidae.

Psychoda harrisi Satchell (Figs. 37-39)
Psychoda harrisi Satchell, 1950, Trans. R. ent. Soc. London, 101:171.

Male. Vestiture gray. *Head:* eyes nearly touching; interocular suture absent; labrum longer than first palpal segment; labellum flattened, bearing 3 long and 1 short teeth and 2 spines; second and third palpal segments relatively short and thick, 3 times as long as broad, ratio of segments 8:10:10:12. *Antenna* with 16 segments, 4/5 times length of wing sensory filaments composed of 2 anterior and 1 posterior branches; terminal three segments reduced in size, separated from each other, flagellar segments XII and XIII subequal in size, XIV smaller than XIII. *Wing* about 2 times as long as broad; bifurcation R_{2+3} little distad of middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 2 times width of cell R_3 at level of bifurcation; ratio of R_{2+3}:R_2:R_3 = 10:10:14. *Genitalia* as figured; dististyle elongate, incurving distally, aedeagus terminating in ventrally curved hook.

Measurements: antenna 1.2 mm.; wing length 1.5 mm.; wing width 0.7 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters. Antenna 5/9 times length of wing. Genitalia as figured; subgenital plate with pair of large, basal lobes, apical portion slender basally and widening distally.

Measurements: wing length 1.6-1.9 mm.; wing width 0.7-0.9 mm.

Type data: New Zealand (Cawthron Institute, Nelson, New Zealand).

Specimens examined: Honolulu, Oahu, January 18, 1951, January 19, 1951, light trap (B. L. Defibaugh); same, January 29, 1951, June, 1952, December, 1950, at light (D. E. Hardy). Waihee, Maui, June, 1952, light trap.

The "fleur-de-lis" shape of the female subgenital plate makes the females of *P. harrisi* readily separable from other Hawaiian psychodids. The elongate, incurving dististyle and the beak-like apex of the aedeagus of the male genitalia, in combination with the sixteen-segmented antenna, separates the males of this species from other species.

Dr. Satchell examined specimens of *P. harrisi* from Hawaii and stated that they were almost identical to specimens from New Zealand. The only difference he detected was a slight variation in the aedeagus of the male.

Psychoda uncinula new species (Figs. 40-43)

Male. Vestiture chiefly gray, vestiture of legs and antenna dark gray. *Head:* eyes separated by distance equal to less than 1 facet diameter; interocular suture absent; labrum little longer than first palpal segment; labellum flattened, bearing 3 (sometimes 4) teeth and 2 spines; palpal segments subequal in diameter, ratio of segments 10:12:12:16. *Antenna* with 16 segments, 4/5 times length of wing; sensory filaments with 2 anterior and 1 posterior branches; terminal 3 segments reduced in size, separated from each other, flagellar segment XIV about ½ size of XIII. *Wing* about 2½ times as long as broad; bifurcation R_{2+3} at middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 3 times width of cell R_3 at level of bifurcation; ratio of R_{2+3}:R_2:R_3 = 10:10:14. *Genitalia* as figured; aedeagus moderately broad, laterally flattened, apex blunt with recurved dorsal barb; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype (antenna lacking); wing length 1.6 mm.; wing width 0.7 mm. Paratypes, antenna 1.2-1.5 mm.; wing length 1.6-2.1 mm.; wing width 0.7-0.9 mm.

Female. Similar to male. Eyes separated by distance equal to 1 facet diameter; antenna about ½ as long as wing. Genitalia as figured; subgenital plate with apical portion parallel-sided, apex with well defined, V-shaped indentation.

Measurements: allotype, antenna 1.0 mm.; wing length 1.9 mm.; wing width 0.8 mm. Paratypes, antenna 0.9-1.3 mm.; wing length 1.5-2.5 mm.; wing width 0.7-0.9 mm.

Type data: holotype ♂, Honolulu, Oahu, January 19, 1951, light trap (B. L. Defibaugh); allotype ♀, same, June, 1952, light trap (D. E. Hardy). Paratypes, 1 ♂, 1 ♀, same data as holotype; 1 ♀, same data as allotype; 2 ♂, 1 ♀, same, January 24, 1951; 1 ♂, Mt. Tantalus, Oahu, January, 1953 (D. E. Hardy); 2 ♂, 5 ♀, Tantalus, Oahu, November 12, 1950 (D. E. Hardy); 1 ♀, same, January 23, 1937, 1700 ft. (F. X. Williams); 2 ♂, 1 ♀, Mt. Kaala, Oahu, November 6, 1945, 4,000 ft. (W. W. Wirth). 1 ♀, Paliku, Haleakala Crater, Maui, June, 1952 (M. Tamashiro); 1 ♀, Makawao, Maui, June, 1952 (D. E. Hardy & M. Tamashiro); 1 ♂, Keanakolu, Hawaii, October, 1952 (D. E. Hardy). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; University of Nebraska, Lincoln; California Academy of Sciences, San Francisco.

Other specimens examined: Mt. Tantalus, Oahu, October 25, 1945, rocky ledges, ferns, etc. (W. W. Wirth); Pupukea, Oahu, December 13, 1952, 1500 ft. (D. E. Hardy).

Psychoda uncinula is separable from other Hawaiian species of *Psychoda* with sixteen-segmented antennae by the parallel-sided female subgenital plate and the barbed aedeagus of the male. This species is most closely related to *P. harrisi*. The females of the two species are easily distinguished, but the males may be confused. However, the barb at the tip of the aedeagus of *P. uncinula* is dorsal in position and quickly tapers to an acute apex, while the recurved hook of the aedeagus of *P. harrisi* is ventral in position, slender and attenuate.

Psychoda uncinula has been erroneously identified as *P. phalaenoides* Linnaeus by W. F. Rapp, Jr. Thus, the latter species has been incorrectly reported from the Hawaiian Islands (Wirth, 1947). Specimens collected on Mt. Tantalus by Dr. Wirth, upon which the record was based, were obtained from Mr. Rapp and determined by the writer to belong to the species described above as *P. uncinula*. This species differs markedly from *P. phalaenoides* in the structure of the male and female genitalia and in

the possession of a sixteen-segmented antenna. *Psychoda phalaenoides* has but fifteen segments in the antenna.

Check List of Hawaiian Psychodidae

Species	Distribution
Trichomyia	
1. **hawaiiensis** Quate	Hawaii
2. **oahuensis** Quate	Oahu
Telmatoscopus	
3. **albipunctatus** Williston	Oahu, Maui Tropicopolitan
Psychoda	
4. **insulicola** Quate	Oahu
5. **alternata** Say	Oahu, Maui, Hawaii Cosmopolitan
6. **pseudalternata** Williams	Oahu Australia
7. **wirthi** Quate	Oahu, Maui, Hawaii
8. **inornata** Grimshaw	Oahu, Maui, Hawaii U.S., Quebec, B.C., Alaska, England, Europe
9. **hardyi** Quate	Oahu, Maui, Hawaii
10. **lucia** Quate	Oahu Florida, West Indies
11. **salicornia** Quate	Oahu California
12. **williamsi** Quate	Oahu, Maui, Hawaii
13. **harrisi** Satchell	Oahu, Maui New Zealand
14. **uncinula** Quate	Oahu, Maui, Hawaii

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A New Scolothrips from Hawaii[1]

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The species described herein, *Scolothrips priesneri,* has been recorded several times ("PROCEEDINGS" 9:417, 1937; 12:24, 1944; 12:331, 1945) under the name of *S. sexmaculatus* (Pergande). The specimen mentioned in a note ("PROCEEDINGS" 12:125, 1944) was not available for re-examination but it probably was *S. priesneri.* The specimens collected in 1910 (?) at Honolulu (Fauna Hawaiiensis 3:700, 1910; "PROCEEDINGS" 7:108, 1928) likewise may have been *S. priesneri.*

Scolothrips are not uncommon in the Hawaiian Islands and were often collected in the cultivated areas as well as in the forested areas at the higher elevations. As far as known to the writer, there are two different species of *Scolothrips* in Hawaii. *S. priesneri* is commoner and *S. pallidus* (Beach) is less common. Mixed colonies of the two species have never been observed.

In his monograph of the genus *Scolothrips* (Bull. Soc. Fouad I Ent. 34:39-68, 1950), Priesner concluded that the Hawaiian species known under the name of *S. sexmaculatus* needed to be re-examined (page 40). Upon his request, material was forwarded to him and he replied that in his opinion it was an undescribed species. He requested the writer to publish the description which had been submitted to him in manuscript form.

Scolothrips priesneri new species

Female holotype: Color (under reflected light on white background): pale lemon yellow without dark grayish shading on body and legs except mesoscutellum. *Antennae:* I hyaline, the rest shaded gray except basal halves of III and IV and basal tip of V. Frontal portion of vertex weakly shaded; mesoscutellum deeply shaded but somewhat lighter in some paratype specimens; lateral corners of mesoscutum and metascutum I except the median portion weakly shaded; laterals of pterothorax, particularly of mesothorax, weakly shaded; forelegs very weakly grayish; in some lighter paratype specimens these weak shadings on body and legs are practically invisible. *Wings:* basal 3/5 of scale and both bands deeply shaded, band II slightly lighter, both bands nearly twice as long as broad and *always* reach both margins broadly. Last four segments of abdomen yellower than the rest and very weakly grayish. Body bristles yellow or light brown except the ones on wing bands which are pale grayish, and the ones on middle segments of abdomen which are hyaline.

(All measurements in microns.) *Head* 85 long, 125 (at eyes) and 120 (at cheeks) wide; eyes laterally produced, 48 long, 40 wide, 45 interval; pronounced bulging of ocellar hump, interocellar bristles 85; mouth cone 150 long. *Antennae* 205 long in total; length (width) of joints are 19(27), 31(24), 37(19), 34(18), 29(15), 42(15), 11(6), and 15(4); V nearly straight on sides. *Prothorax* 95 long, 135 (foremargin) and 175 (hind margin) wide; bristles on foremargin, b.1: 50, b.2: 120, b.3: 45, b.4: 110; lateral bristles 105; bristles on hind margin, b.1: 115, b.2: 60, b.3: 105, b.4: 100; *prebasal setae wanting. Pterothorax* 275 long, 240 wide; metascutum I, b.1: 47 long and 10 microns shorter from

[1] Published with the approval of the Director of the Pineapple Research Institute of Hawaii as Technical Paper No. 215.

the hind margin of metascutum; hind tibiae 160 long. *Wings* 705 long, 59 wide at both bands; band I 95 long, band II 100 long; costal bristles 130 (at band I) and 145 (at band II) long; b.2 on scale 115 long; number of bristles on costa 19, forevein 9, hind vein 5. *Abdomen* 730 long, 250 (at III) wide; bristles on IX, b.1 and b.2: 75, b.3: 80, dorsal bristles 36; bristles on X, b.1: 70, b.2: 65; ovipositor 210 long. Total body length 1145.

Measurements from 10 paratype specimens: Mean or average (Min.-Max.). *Head* 75 (70-85) long, 120(110-125) wide at eyes, 115(110-120) wide at cheeks; interocellar bristles 85 (80-90) long; mouth cone 150 (140-165) long. *Antennae*, I: 18 (17-19) long, 27 (26-27) wide; II: 32(30-33) long, 24(24-25) wide; III: 36(34-38) long, 19(18-20) wide; IV: 32(31-34) long, 18(18-19) wide; V: 28(28-29) long, 15(14-16) wide; VI: 42(40-44) long, 15 wide; VII: 11(10-12) long, 7(6-8) wide; VIII: 15(14-16) long, 4.5(4-5) wide; total length: 205 (190-212). *Prothorax* 95(90-105) long, 130(115-140) wide along foremargin; 165(150-175) wide along hind margin; bristles on foremargin, b.1: 52(50-55), b.2: 115(105-120), b.3: 40(36-45), b.4: 100(95-110); lateral bristles 100(90-110); bristles on hind margin, b.1: 110(100-115), b.2: 55(45-64), b.3: 100(90-105), b.4: 95(90-105). *Pterothorax* 240(230-275) long, 225(200-240) wide; hind tibiae 160(155-165) long. *Wings* 685(640-730) long, 57(55-59) wide at band I, 55(53-59) wide at band II; band I 95(90-116) long, band II 95(80-105) long; costal bristles 125(110-130) long at band I, 140(130-155) long at band II; b.2 of scale 105(100-115) long; number of bristles on costa 20(19-23), on forevein 9(9-10), on hind vein 5(4-6). *Abdomen* 700(660-740) long, 240(210-260) wide at III; bristles on IX, b.1 and b.2: 75(70-80), b.3: 82(80-85), dorsal: 38(32-40); bristles on X, b.1: 70(60-75), b.2: 65(60-65); ovipositor 200(195-220) long. Total body length 1100(1000-1230).

Male allotype: Color: Pale yellow to pale grayish yellow. Grayish shadings same as in female; in addition, abd. VIII (weakly) and IX (distinctly) always shaded. Bands I and II of wings same as in a female.

Head 78 long, 110 (at eyes) and 100 (at cheeks) wide; eyes 45 long, 36(?) wide, 36(?) interval; bulging ocellar hump; interocellar bristles 70 long. *Antennae* 190 long in total; length (width) of joints are 14(23), 28(22), 32(16), 26(16), 26(14), 37(15), 9(7), and 15(4); V straight on sides. *Prothorax* 90 long, 120 (foremargin) and 150 (hind margin) wide; bristles on foremargin, b.1: 36, b.2: 93, b.3: 32, b.4: 80; bristles on hind margin, b.1: 90, b.2: 42, b.3: 75, b.4: 80; *prebasal setae wanting. Pterothorax* 200 long, 170(?) wide; hind tibiae 120 long. *Wings fully developed;* 520 long, 44 (at band I) and 38 (at band II) wide, gradually tapered; band I 78 long, band II 90 long; costal bristles 90 (at band I) and 115 (at band II) long; b.2 on scale 85 long; number of bristles on costa 17-18, forevein 9, hind vein 4-5. *Abdomen* 500+ long, 175 (at III) wide; bristles on IX, b.1: 50 long and 21 microns apart from the hind margin, b.2: 20 long and 8 apart, b.3: 8 long and 17 apart, b.4: 60 long and 8 apart, they are on two different levels, dorsal bristles 22 long; sternites III-VIII with very broad dumb-bell shaped glandular areas, III: 100 wide, 9 (at constricted part) and 16 (at broader part) long, VI: 120 wide, 7 and 20 long. Total body length 860+.

Specimens examined: Female holotype—Manoa, Oahu; *Asystasia coromandeliana;* November 3-16, 1943; K. Sakimura (Saki. 2918-19). Male allotype—Puuwaawaa, Hawaii; *Erythrina monosperma;* January 3, 1947; K. S. (Saki. 2160). Paratypes are: 1♀—Waipahu, Oahu; *Xanthium* sp.; March 8, 1931; K. S. (Saki. 372). 4♀—Manoa, Oahu; October 23, 1940; C. T. Schmidt. 1♀—Manoa, Oahu, tomato; September 25, 1942; K. S. (Saki. 1258). 1♀—Aiea, Oahu; *Hibiscus rosa-sinensis;* September 29, 1942; K. S. (Saki. 1408). 1♀—Hilo, Hawaii; *Passiflora* sp.; March 15, 1945; W. C. Look (Saki. 1671). 1♀—South Kohala, Hawaii; *Sonchus oleraceus;* August 3, 1945; W. C. Look (Saki. 1702). 1♀, 1♂—same as allotype. 1♀—Waikoloa, Hawaii; *Dodonaea viscosa;* January 3, 1947; K. S. (Saki. 2162). 4♀, 6♂—Kapahulu, Oahu; *Ficus carica;* August 18, 1943; I. Yanagihara (Saki. 2810). 1♀—Waipahu, Oahu; asparagus; September 15, 1943; K. S. (Saki. 2830/19A). 1♂—Waipahu, Oahu; *Colocasia esculenta;* September 15, 1943; K. S. (Saki. 2830/21). 1♀—Waialae, Oahu; *Eugenia uniflora;* October 11, 1943; K. S. (Saki. 2854). 2♂—same as holotype. 1♀—Aiea, Oahu; *Pluchea odorata;* December 1, 1943; K. S. (Saki. 2956). 10♀, 2♂, 6 immature stages—Kunia, Oahu; *Colocasia esculenta;* November 5, 1946; K. S. (Saki. 3253). 7♀, 4♂—Lualualei, Oahu; *Ipomoea pentaphylla;* June 6, 1943; T. Nishida (Saki. 3722) (Haw. Agr. Exp. Sta. Dept. Ent. 3367).

The holotype and allotype were deposited in Dr. Priesner's collection, and the paratypes, in the writer's collection. Some of the paratypes are

to be deposited in the Bernice P. Bishop Museum, Honolulu, Hawaii, and the U. S. National Museum, Washington, D. C.

The species is named after Dr. H. Priesner of Cairo, Egypt, who made a great contribution to the knowledge of the genus *Scolothrips*.

Dr. Priesner stated in his letter that *priesneri* is structurally similar to *longicornis* Priesner but differs in coloration. In addition, the male has fully developed wings and cannot, therefore, be identical with *longicornis*. All the specimens of the latter species he has seen were hemimacropterous.

Structurally, females of *priesneri* are similar to *longicornis* from which it is separated by shorter antennae (190-212 *vs.* 220-235), particularly shorter II, V, and VI; slightly longer prothorax bristles (95-120 and 36-64 *vs.* 90-105 and 32-52); shorter hind tibiae (155-165 *vs.* 160-180); and slightly shorter bristles on abdominal IX (70-85 *vs.* 80-95). Antennal formula of *priesneri* is nearer to that of *sexmaculatus*. In coloration, however, *priesneri* is strikingly different from *longicornis*, which has no dark shading on body and legs, and has a spot-like wing band I without reaching the hind margin. In *priesneri*, antennal joint II is wholly shaded, mesoscutellum is deeply shaded, and both wing bands are longer than broad and *always broadly* reach both margins.

With two broad wing bands broadly reaching both margins, *priesneri* is separated from all the known species, including *sexmaculatus*, *pallidus*, and *longicornis*, except the following 5 species. However, *priesneri* is further separated from the five as follows: *hoodi* Priesner by prebasal setae of prothorax, *takahashii* Priesner and *latipennis* Priesner by broader wings, *hartwigi* Priesner by shading on scale, and *lanzarotensis* Priesner by other body colorations.

List of Sugar-Cane Insects

A Synonymic Catalogue of the Sugar-Cane Insects and Mites of the World, and of their Insect Parasites and Predators, Arranged Systematically.[1]

(A Review)

By L. D. TUTHILL

This work should be of great value to anyone concerned with sugar-cane insects. It presents in a convenient form all "available" records of such insects and mites, their parasites, and insect predators. In the author's words, "An attempt has been made at completeness to .... December, 1952." The criterion for inclusion of a species in the list has been that it feeds on the tissues of the sugar-cane plant. This excludes some species which may be commonly associated with sugar cane but which do not attack the plant itself.

The paper is in two parts. Part I lists the sugar-cane insects by order, family, and scientific name; gives the country or countries where it is known to attack sugar cane; and cites any known parasites or predators, by genus. Part II is a list of the parasites and predators, the known host or hosts, and the known distribution.

Synonyms and erroneous names are included in the list and cross-referenced.

[1] By Harold E. Box. 101 pp. Commonwealth Institute of Entomology, London, 1953. Price $2.25.

Studies on the Giant African Snail

By P. W. WEBER

BOARD OF AGRICULTURE AND FORESTRY

(Presidential Address, presented at the meeting of December 14, 1953)

The presence of the giant African snail in Hawaii was discovered in 1938 when a Honolulu resident sought information from the Board of Agriculture and Forestry as to the best methods of breeding it. He had read about a person on Maui who was raising them for food and medicinal purposes and had obtained some for his own use. These had been brought in from Japan in 1936 through the mails and had escaped detection by inspectors. The snails were identified by Dr. C. M. Cooke of the Bishop Museum and the serious nature of the situation recognized. The six snails found in Honolulu were confiscated and the large number in the hatchery on Maui destroyed.

Soon after, other lots were discovered in Honolulu, which were the progeny of some snails brought by a resident returning from Formosa in 1936. These were also destroyed. The Board had high hopes that the infestation had been wiped out, but in the years to come it became more and more apparent that the snails were on the increase and measures had to be taken to suppress them.

The first method of control tried was the use of a 1% spray of Penite, which was applied to the ground and vegetation in the infested areas. This gave very good results, with kills approaching 100%. It is believed that most of the snails were killed by poison absorbed through the foot as the snail passed over the ground, but some may have been killed by ingesting the poison on the leaves as they fed.

Due to the high toxicity of the arsenic in Penite it is not practical for use in residential areas. Here we have had to resort to the use of a standard commercial molluscicide, Bug-Geta pellets, which contain bran as a food or attrahent and the poison metaldehyde. These are scattered among plants and other places where the snails hide.

The next method of control practiced was the distribution of rocks coated with a mixture of calcium arsenate, lime, and cement, the cement acting as a binder. This whitewash is painted on rocks, tree trunks, and other objects upon which the snail might climb. The theory is that the snails are attracted to the calcium which they need for their shells and are killed when they eat the arsenic. The rocks were #2 grade stones, measuring approximately 2x4 inches. These were distributed by hand, spaced about 10 feet apart each way. Later on it was felt that closer spacing, with greater opportunity for contact, would result in a higher mortality. Accordingly we ran tests with equal weights of large and small stones spaced over a plot of ground 50x75 feet. Equal weights were chosen

in order to keep the cost of the stones at the same level. With the 10-foot spacing 48 large stones were used. An extra 250 snails were planted in the area to increase the population, which was estimated at 300. The rocks were left for one week, after which all snails were collected for counting and examination. A total of 729 snails of all sizes was found. These were held for one week before examination to allow for delayed poisoning to take effect. Based on an estimated population of 750, the 51 dead snails gave a mortality of 6.8%.

The smaller stones, of #3 coarse grade, measured about ¾-1 inch in each dimension, there being about 1300 stones to be spaced 1 foot 9 inches apart over the lot. The same test was repeated and resulted in a total of 300 snails being killed, or a mortality of 40%.

As a partial check on this figure, every other rock was removed and a third lot of snails introduced. As could be expected the number of dead snails, 138, and the mortality, 18.4%, fell in between the corresponding figures for the wide and close spacings. The use of small stones with a spacing of approximately two feet is the method of control now in practice.

Metaldehyde was tried as a poison to be used in residential and pasture areas where arsenic could not be used. It was found that a spray of wettable metaldehyde applied at the rate of 5 pounds per acre was very effective, the same strength in dust form being nowhere near the spray in effectiveness. This can be used with perfect safety on plants and around the yard.

We next turned to trials of food preferences in an effort to find some substance attractive enough to snails to serve as a lure. A 15-foot circular cage was built out of hardware cloth. A certain amount of the material under test was put out as food and a second lot placed outside the cage to serve as a check on loss of weight due to dessication. All foods were exposed for two nights, with the snails being placed near them each time. Twenty large snails were used, the same snails being used throughout the experiment.

The following materials were tested: *Passiflora foetida, P. laurifolia,* peanuts, papaya, lettuce, koa haole, sweet potato leaves, cabbage, crushed African snails, and bell pepper leaves. These were selected on the basis of various reports and observations, either of snails being found on these objects in the field in large numbers, or of having apparently shown a special taste for them.

The entire vine of the two species of passion fruit was used. In one case the amount eaten was calculated to be ⅛ oz. and in the other ¼ oz. With peanuts, the entire plant was tested, the stems being gathered in loose bunches. The amount eaten was calculated to be ⅛ oz. Several snails were cracked and laid out on small pans. Of these also ⅛ oz. was assumed to be eaten. These figures were arrived at by recalculating the original weight of the amount of food remaining in the same ratio as the amount of the check remaining, and subtracting it from the weight of food put out. All of these differences are so small that they are thought to be due to experimental error, as no evidence of feeding could be found.

Papayas were cut in half and the seeds removed; of 17 oz. put out, 1⅛ oz. were eaten. Seven oz. of koa haole branch tips were put out and 1½ oz. eaten. One pound of cabbage was exposed and 2⅞ oz. eaten. One pound of sweet potato leaves was exposed, 11⅞ oz. being eaten. One pound of lettuce leaves was put out and the entire amount consumed during the first night. From this it will be seen that sweet potato leaves and lettuce were outstanding as foods selected by the snails.

Following this tests were conducted on the ability of the snails and their eggs to withstand cold temperatures. These tests were conducted in standard refrigerators adjusted to run within two degrees of the desired temperature and equipped with hygrothermographs. It was found that an exposure of 24 hours at 45° F. was enough to prevent hatching of the eggs, whether buried in soil or exposed on the surface. All indications point to the fact that eggs are easily affected, the contents drying up within a few days.

The next tests were conducted with dormant and active snails exposed on the surface of damp soil in small pans, and also buried in soil in cardboard boxes, with at least three inches of soil surrounding the snails on all sides. All snails were held for seven days for mortality counts. It was found that with active snails an exposure of 8 hours at 20°, 12 hours at 30°, 24 hours at 40°, and 4 days at 45° were lethal. Upon removal from the cold chambers, the snail bodies were dried and shriveled, while in many liquid filled the aperture to the lip.

In the case of active snails buried in soil, 8 hours at 20°, 24 hours at 30°, 48 hours at 40°, and 4 days at 45° were required to produce 100% mortality.

With dormant snails a longer period was required at each temperature, this period increasing as the temperature rose. Twelve hours were required at 20°, 24 at 30°, 48 at 40°, and 7 days at 45°.

A series of tests on the attractiveness of various odorous chemicals and other materials was run in the cage. We first determined the normal movement of 50 large snails placed in the center of the cage and allowed to roam at will, with nothing in the cage. In a series of tests it was found that ¾ or more of the snails would be found the next morning against the fence in the quarter directly downwind, with all but one or two of the rest below the midline of the cage. There was a constant breeze with a velocity of from two to ten miles per hour. To find out whether or not this movement was due to wind effect, we installed a blower outside the cage directed at the area where the snails were clustered. In each of several tests we found that the snails moved away from the air current to either side, with a few being found on the ceiling of the cage. Further checks were made with the cage covered with a tarpaulin and with the tarpaulin erected as a windbreak around the cage. In this series we received a very random distribution of snails, there being no similarity of pattern between any two tests. This indicates that the snails react negatively to an air current and were not affected by the slight downward slope of the ground within the cage. Therefore any positive reaction should be due to the attractiveness of the lure. With this in mind we tested a number of materials. These were exposed at the upwind center

margin of the cage, either in shallow pans or as liquids absorbed on pieces of filter paper. The distance from the point of exposure to the center of the cage was 7½ feet. To check whether or not the odor was being lifted above the snails' horizon we made tests with smoke drift and also by sniffing at the ground in the cage center where the snails were placed for each test. In each case there was no doubt that the wind currents were carrying the scent to the desired place.

The following materials were selected, either for odoriferous qualities or for the reasons given previously:

Aku head soup
Commercial fish oil
Molasses
Fermenting molasses
Fish meal
Fermenting fish meal
Fish viscera preserved with salt and with sulfuric acid
Koa haole leaves
Koa haole leaves ground up in a blendor
Wheat bran
Fermenting wheat bran
Dry metaldehyde
Metaldehyde in solution
Iso-valeric acid
N-valeric acid
Propionic acid
Butyric acid
Acetaldehyde
Formaldehyde
Turpentine
Acetone

All these substances proved to be entirely negative, there being no attraction beyond 1 or 2 snails in any test that were found near the upwind margin and considered to be of no significance.

In the field of biological control we have introduced into Hawaii several predators. One of these is a large carabid beetle, *Tefflus hacquardi,* which is predacious in both the larval and adult stages. The eggs are encased in helmet-shaped mud cells about 10x15 mm. On one end there is only a thin wall of mud, through which the young larva emerges. At this time it is capable of attacking small snails up to 1 inch long. They prefer to feed early in the morning but have been observed feeding at all times of the day. There are three larval instars, the larvae being about 35 mm. long and 12 mm. wide after the last molt. This occurs 2-2½ months after the eggs are laid. They eat an average of three snails a day and stop feeding 3-4 days before going into the final molt. A cell is dug in the ground about 1½ times their length and half as high. The pupal stage lasts from 11-14 days, the adult beetle resting in the cell for 2-3 days before digging its way out to the surface.

The adults mate in the latter part of September and begin laying eggs in October, this continuing for three or four months. Up to 40 eggs are

laid during a season. They also prefer to feed in the early morning, and remain in hiding during the day. Usually one medium-sized snail is eaten per day.

They can squirt an acid substance from the posterior end of the abdomen when disturbed or handled. This is strong enough to cause burns on the skin if not washed off soon enough.

Other predators belong to the *Streptaxidae,* a family of carnivorous snails. These are *Streptaxis kibweziensis* and *Edentulina affinis,* which were introduced from Africa. We have had no success in propagating *Edentulina,* but have been able to breed *Streptaxis.* They are oviparous, laying 3-4 eggs at a time. The young snails require about 6 months to reach maturity.

Both *Tefflus* and *Streptaxis* have been liberated in the Kaneohe area. They were marked so that if any were recovered we could tell whether they were progeny of the specimens liberated. One first generation specimen of *Tefflus* was recovered near the point of liberation, but no progeny of *Streptaxis* have been found.

Another predator introduced was the lampyrid *Lamprophorus tenebrosus,* which was brought from Ceylon. These are predaceous in the larval stages, lacerating the flesh of the snail and feeding on the liquid secreted by the snail in defense and on the semi-liquid contents of the intestine. These we have been unable to propagate, all larvae dying before they reached maturity. We hope to secure more and be able to add another enemy in the campaign against the snail.

We realize that the surface has barely been scratched in work on control of these snails and that much remains to be done before any satisfactory results will be obtained. We would be most appreciative of any constructive, or, for that matter, destructive ideas you may have which may help in our efforts to bring this pest under control.

Recent Liberations of Beneficial Insects—III

By P. W. WEBER

BOARD OF AGRICULTURE AND FORESTRY

The following liberations of beneficial insects have been made by the Board of Agriculture and Forestry since the last listing was published.[1]

Brachymeria sp.

This chalcid, introduced from Nairobi, Kenya, for the control of *Plutella maculipennis* Curtis, was liberated at Kamuela, Hawaii, on March 17 and in Makaha Valley, Oahu, on March 20.

Allograpta sp.

Adults of a syrphid fly of this genus, sent from Cuba to feed on aphids, were released in Kaimuki, Oahu, on April 30.

Lysiphlebus sp.

A number of this braconid parasite, bred from *Aphis* sp. in Cuba, were liberated in Makiki, Oahu, on April 23.

Horogenes sp.

This ichneumonid, near *insularis* (Ashmead) but with a light stigma, was brought from Africa for the control of *Plutella*. It was first liberated in Makaha Valley, Oahu, on May 7.

Tetrastichus sp.

Also introduced from Africa for the control of *Plutella*, this eulophid was released in Kaneohe, Oahu, on May 28 and at Kamuela, Hawaii, on June 23.

Liothrips urichi Karny.

This thrips was brought from Fiji to control the weed *Clidemia hirta*, which was found established recently in the Wahiawa forest reserve. The first release was made on June 1.

Apanteles sp.

Perisierola sp.

Microbracon spp.

Eiphosoma sp.

These wasps were bred from the pigeon-pea borer *Ancylostomia stercorea* (Zeller) in Trinidad and introduced for trial on *Maruca*. *Apanteles* and *Microbracon* were released on Oahu at Waimano Home on June 1 and 5, respectively, while *Perisierola* was released in Lualualei Valley on June 9 and *Eiphosoma* in Makiki on the same date.

[1] The previous paper in this series appeared in the "PROCEEDINGS," 15(1):127-130, 1952.

Pyrophorus pellucens Eschscholtz.

This elaterid was introduced from Trinidad as a possible predator on *Adoretus sinicus* Burmeister. It was liberated in the rose gardens at Koko Head, Oahu, on June 5.

Lioscymnus diversipes Champion.

This coccinellid was also introduced from Trinidad and is a predator on the bamboo scale. It was liberated in Makiki, Oahu, on June 5.

Baccha sp.

A number of this syrphid fly were released on Oahu to prey on aphids, the first release being made in Makiki on June 7. It also was brought from Trinidad.

Leionota sp.

This histerid was introduced from Trinidad as a general predator. It was released at the University of Hawâii dairy and the Kalihi forest reserve on Oahu on July 16.

Blepharomastix acutangulalis (Snellen).

This pyralid moth was collected on *Lantana camara* at Cuernavaca, Mexico. The larvae attack the plant by curling the leaves, especially at the tips of the branches, with silky webs and feeding on the leaves within. It was released at Kunia, Oahu, on October 20; Waikapu, Maui, on October 30, and Naalehu, Hawaii, on November 30.

Octotoma scabripennis Guérin.

This chrysomelid was also found at Cuernavaca. The adults feed on the leaves of Lantana while the larvae are leaf-miners. It was released at Kunia, Oahu, on November 12.

Immigrant Insect Records for the Year 1953

Species marked with an asterisk were reported in the Hawaiian Islands for the first time in 1951 on the dates recorded in the text. Those not so marked were observed here prior to that year, but have only now been identified or recorded. For particulars refer to the pages indicated.

CHANCE IMMIGRANTS

	PAGE
*Polyplax serrata (Burmeister) (Anoplura: Haematopinidae)	263
*Petrobia sp. (Acarina: Tetranychidae)	265
*Encyrtus lecaniorum (Mayr) (Hymenoptera: Encyrtidae)	266
*Muscina assimilis (Fallén) (Diptera: Muscidae)	272
*Parafannia molluscovora Bohart (Diptera: Phoridae)	273
*Diploneura cornuta Bigot (Diptera: Phoridae)	274
Phaenicia cuprina Wiedemann (Diptera: Calliphoridae)	274
*Deltocephalus sonorus Ball (Homoptera: Cicadellidae)	279
*Undetermined moth (Family near Tineidae)	280
*Haltichella sp. (Hymenoptera: Chalcididae)	280
*Corythuca morrilli Osborn and Drake (Heteroptera: Tingidae)	282
*Dermestes unicolor Lepesme (Coleoptera: Dermestidae)	284
*Dermestes frischii Kugelann (Coleoptera: Dermestidae)	284
*Dermestes sp. (Coleoptera: Dermestidae)	284
Blapstinus sp. (Coleoptera: Tenebrionidae)	284
*Hypophloeus sp. (Coleoptera: Tenebrionidae)	284
*Haemolaelaps megaventralis (Strandtmann) (Acarina: Laelaptidae)	285
*Taeniothrips vitticornis (Karny) (Thysanoptera: Thripidae)	285
*Chlorion thomae (F.) (Hymenoptera: Sphecidae)	287
*Scaphytopius loricatus (Van Duzee) (Homoptera: Cicadellidae)	287
*Polididus armatissimus Stål (Heteroptera: Reduviidae)	289

BENEFICIAL INSECTS PURPOSELY INTRODUCED

	PAGE
*Tefflus hacquardi de Chaudoir (Coleoptera: Carabidae)	270
*Horogenes sp. (Hymenoptera: Ichneumonidae)	280
*Cyrtorhinus lividipennis Reuter (Heteroptera: Miridae)	280
*Liothrips urichi Karny (Thysanoptera: Phlaeothripidae)	280
*Tetrastichus sp. (Hymenoptera: Eulophidae)	280
*Brachymeria sp. (Hymenoptera: Chalcididae)	369
*Allograpta sp. (Diptera: Syrphidae)	369
*Lysiphlebus sp. (Hymenoptera: Braconidae)	369
*Apanteles sp. (Hymenoptera: Braconidae)	369
*Perisierola sp. (Hymenoptera: Bethylidae)	369
*Microbracon spp. (Hymenoptera: Braconidae)	369
*Eiphosoma sp. (Hymenoptera: Ichneumonidae)	369
*Pyrophorus pellucens Eschscholtz (Coleoptera: Elateridae)	370
*Lioscymnus diversipes Champion (Coleoptera: Coccinellidae)	370
*Baccha sp. (Diptera: Syrphidae)	370
*Leionota sp. (Coleoptera: Histeridae)	370
*Blepharomastix acutangulalis (Snellen) (Lepidoptera: Pyralidae)	370
*Octotoma scabripennis Guérin (Coleoptera: Chrysomelidae)	370

CONTENTS OF VOL. XV, NO. 2, MARCH, 1954

(Actual date of publication, March 5, 1954)

Minutes, Notes and Exhibitions — PAGE

January meeting 263
February meeting 265
March meeting 267
April meeting 270
May meeting 273
June meeting 278
July meeting 279
August meeting 281
September meeting 283
October meeting 286
November meeting 288
December meeting 289

Election of Officers for 1954 289

New Insect Records for 1953 371

PAPERS

ADACHI, MARIAN S.:
Preliminary Studies in Hawaiian Dolichopodidae (Diptera) Part II. The Genus Emperoptera Grimshaw 293

ALEXANDER, CHARLES P.:
An Undescribed Crane-Fly from the Hawaiian Islands (Diptera: Tipulidae) 297

DRESNER, EDGAR:
Observations on the Biology and Habits of Pupal Parasites of the Oriental Fruit Fly 299

FORD, E. J., JR.:
The Genus Xyletobius on Oahu, with Descriptions of New Species (Coleoptera: Anobiidae) 311

GRESSITT, J. LINSLEY:
The Longicorn Genus Thranius (Coleoptera: Cerambycidae) 317

HARDY, D. ELMO:
Notes and Descriptions on Australian Fruit Flies (Diptera: Tephritidae) 327

QUATE, LARRY W.:
A Revision of the Psychodidae of the Hawaiian Islands (Diptera) 335

SAKIMURA, K.:
A New Scolothrips from Hawaii 357

TUTHILL, L. D.:
Book Review: A Synonymic Catalogue of the Sugar-Cane Insects and Mites of the World, and of their Insect Parasites and Predators, Arranged Systematically. Harold E. Box 361

WEBER, P. W.:
Studies on the Giant African Snail (Presidential Address) 363
Recent Liberations of Beneficial Insects—III 369

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